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Kohn, A. J. 1960*a*. Ecological notes on *Conus* (Mollusca: Gastropoda) in the Trincomalee region of Ceylon. *Ann. Mag. nat. Hist.* (13) **2**: 309–320.
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Thiele, J. 1910. Mollusca: B. Polyplacophora, Gastropoda marina, Bivalvia. *In:* Schultze, L. *Zoologische und anthropologische Ergebnisse einer Forschungsreise im westlichen und zentralen Süd-Afrika* **4**: 269–270. Jena: Fischer. *Denkschr. med.-naturw. Ges. Jena* **16**: 269–270.

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Volume **94** Band

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A NEW ANT GENUS FROM SOUTHERN AFRICA (HYMENOPTERA, FORMICIDAE)

By

A. J. PRINS

Cape Town Kaapstad

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A NEW ANT GENUS FROM SOUTHERN AFRICA (HYMENOPTERA, FORMICIDAE)

By

A. J. Prins

South African Museum, Cape Town

(With 4 figures)

[*MS accepted 22 September 1983*]

ABSTRACT

A new genus and its two new species, *Agraulomyrmex meridionalis* and *A. wilsoni*, are described and a key to the workers of the genera of the subfamily Formicinae present in this subregion is provided.

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INTRODUCTION

In 1969 surveys of ants present in citrus orchards were conducted throughout South Africa. During the cooler winter months and early spring one sample of small, brownish hypogaeic ants was collected among some citrus trees in the veld near Velddrif, a small fishing village about 200 km north-west of Cape Town. As these ants looked very much like *Technomyrmex albipes* (F. Smith), which shared the same habitat, they were noted as such in the collection records. This same species of ant was also at the time observed in a small citrus orchard near Citrusdal, about 60 km north-east of Velddrif. In this case they were tending the aphid *Hyadaphis coriandri* (Das) on warm days, about 4 to 7 cm above ground level on the low-growing weeds. They were, however, never observed during the summer and autumn months.

Three years later a sample received from the Ministry of Agriculture of Zimbabwe (formerly Rhodesia) proved to be a different species of this new genus, which includes the only southern African formicine ants of which the workers have ten-segmented antennae.

Ann. S. Afr. Mus. **94** (1), 1983: 1–11, 4 figs.

Genus *Agraulomyrmex* gen. nov.

Type species *Agraulomyrmex meridionalis* sp. nov.
by original designation herein

Diagnosis

Small ants with ten-segmented antennae, flagella incrassate towards apices without distinct club; first and last segments of flagella longer than wide, the remaining segments as long as or wider than long. Mandibles triangular with four to six teeth; frontal carinae short, antennal fossae situated close to posterior border of clypeus. Eyes large, placed in front of middle of sides of head; ocelli absent. Maxillary palpi five- to six-segmented, labial palp three- to four-segmented. Labrum bilobed, widely and shallowly emarginate in middle. Frontal area clearly indicated.

Alitrunk with promesonotal and mesonotal-propodeal sutures well developed, mesometanotal suture absent; propodeum rounded from front to back, unarmed. Petiole with very small or rudimentary scale overhung by base of abdomen. Legs moderately long.

Although the ten-segmented antennae point to a myrmelachistine relationship, these ants share characters with the plagiolepidines, viz. the absence of a distinct antennal club, the structure and form of the alitrunk (the absence of a distinct metanotum as in certain members such as the genus *Acropyga*), as well as the structure of the asepalous proventriculus (Fig. 4A–D). The new genus is therefore included in the tribe Plagiolepidini.

Workers of these ants bear a close resemblance to those of the genus *Acropyga* (Prins 1982); however, they are much smaller and darker in colour, and the eyes are much larger. In members of *Acropyga* the eyes are very small, consisting of only a few facets. The petiolar scale is also much more reduced than in *Acropyga*.

Derivation of name

The name *Agraulomyrmex* (masculine gender) is derived from the Greek word *agraulos*, which refers to the mode of living (in the fields).

Agraulomyrmex meridionalis sp. nov.

Description

Worker (Fig. 1A–C)

Specimens collected at Velddrif from which the type material was selected: TL 2,10–2,20 mm; L0,90–1,0 mm; HL 0,48–0,52 mm; ED 0,26 mm; CL 0,08–0,10 mm; FL 0,40–0,42 mm; SL 0,32–0,36 mm; WL 0,48–0,50 mm; MFL 0,28–0,30 mm; HFL 0,32–0,36 mm; PL 0,10 mm; CI 76,9–79,2; FI 61,9–65,0; SI 84,2–90,0; CLI 320,0–355,6; TI 58,0–58,3; PI 100,0; HFI 66,7–72,0.

Dark brown, tarsi and mandibles paler. Smooth and shiny all over, especially declivity of propodeum and petiole. Finely sculptured with piliferous punctures.

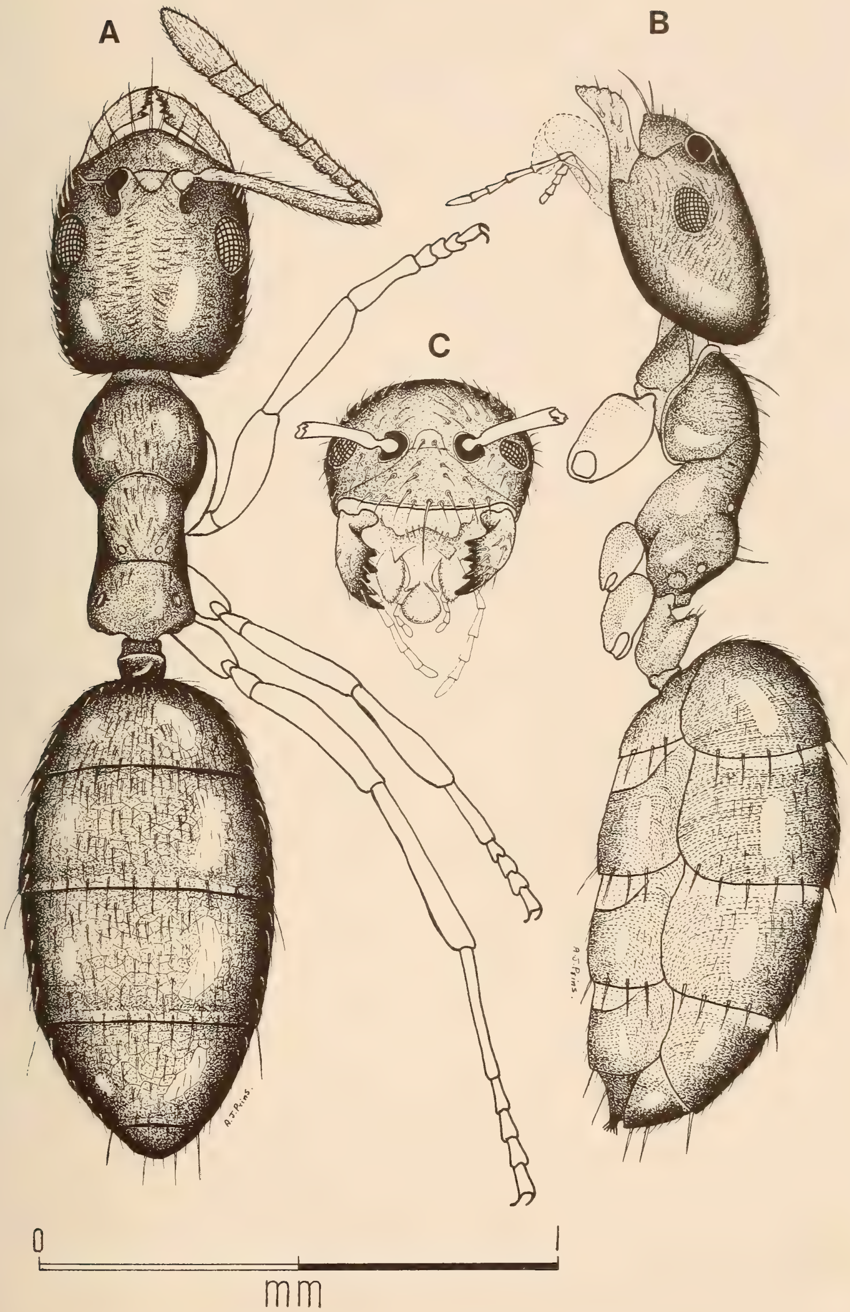

Fig. 1. *Agraulomyrmex meridionalis* sp. nov.
A. Dorsal view of worker. B. Left lateral view of worker. C. Head of worker seen from the front.

Pubescence fairly long, decumbent and yellowish, dense all over except on petiole and declivity. Pilosity yellowish, long, evident only on mandibles, clypeus, petiole, and apical margins of abdominal segments.

Head quadrate in dorsal view, about one-fifth to one-sixth longer than wide, and about one-third wider than pronotum, sides feebly convex, hind margin almost straight. Clypeus convex in middle, not carinate, its anterior margin arcuate as in the genus *Acropyga*. Scapes about two-thirds as long as head (excluding mandibles) and reaching hind margin; flagellum about two-fifths longer than scape, first segment as long as the second and third taken together, apical one slightly longer than three preceding segments taken together; rest as wide as, or wider than, long. Eyes large, oval, occupying nearly one-fourth of the length of head (dorsal view—mandibles excluded), and situated in front of middle of sides. Mandibles shiny, with few large, oval punctures, each bearing erect or semi-erect seta, and with five to six alternate large and small teeth. Maxillary palp six-segmented, labial palp four-segmented.

Alitrunk similar to that of the genus *Acropyga*, slightly more than three-eighths longer than wide over pronotum; seen in profile propodeum is on lower level than promesonotum, declivity almost flat and longer than dorsum of propodeum. Scale of petiole rudimentary, inclined forward and about as long as wide and slightly higher than long; seen from behind almost as wide above as below, dorsum feebly convex.

Legs moderately long. Abdomen oval in dorsal view. Acidopore on conical projection of hypopygium, orifice surrounded by fringe of hairs.

Specimens which do not form part of the type material and which were collected at Citrusdal have the following representative measurements:

TL 2,0–2,20 mm; L 0,94–1,0 mm; HL 0,44–0,48 mm; ED 0,22–0,26 mm; CL 0,09–0,10 mm; FL 0,34–0,39 mm; SL 0,32–0,34 mm; WL 0,46–0,52 mm; MFL 0,26–0,28 mm; HFL 0,32–0,34 mm; PL 0,10–0,11 mm; CI 77,3–83,3; FI 64,1–68,4; SI 85,0–94,1; CLI 320,0–355,6; TI 53,8–56,5; PI 80,0–90,0; HFI 65,3–69,61.

In most of the specimens examined the head is somewhat shorter than the alitrunk and the scale of the petiole slightly longer than wide, otherwise similar in all respects to the Velddrif specimens.

Holotype

1 ☿, Velddrif, Cape Province (32°47′S 18°10′E), collected by A. J. Prins 7 July 1959, South African Museum specimen.

Paratypes

4 ☿☿, as above, South African Museum specimens.

Other material

Not included in the type material: 4 ☿☿, Citrusdal, Cape Province (32°37′S 18°58′E), collected by A. J. Prins 17 March 1960, South African Museum specimens.

Derivation of name

The name *meridionalis* is derived from the Latin word *meridional-*, which refers to the southerly distribution of this species.

Agraulomyrmex wilsoni sp. nov.

Description

Worker (Fig. 2A–C)

TL 1,5–1,90 mm; L 0,66–0,7 mm; HL 0,34 mm; ED 0,20–0,21 mm; CL 0,05–0,06 mm; FL 0,28–0,29 mm; SL 0,20–0,21 mm; WL 0,34 mm; MFL 0,14 mm; HFL 0,18 mm; PL 0,07–0,08 mm; CI 88,2–94,1; FI 68,9–75,0; SI 65,6–73,3; CLI 336,7–440,0; TI 57,8; PI 87,5–114,3; HFI 52,9.

Brown; antennae, mandibles, legs and mesonotum paler in colour, almost brownish white in some individuals; eyes black. Fairly shiny all over. Finely sculptured with piliferous punctures as in *A. meridionalis*, giving integument an almost fine reticulate or reticulate-punctate appearance; in some specimens head somewhat duller than in *A. meridionalis*. Pubescence and pilosity as in *A. meridionalis*.

Head quadrate in dorsal view, about one-sixth (or slightly more) longer than wide and three-eighths wider than pronotum, sides and hind margin almost straight. Clypeus and mandibles as in *A. meridionalis*, latter with four sharp teeth. Scapes slightly more than three-quarters as long as head (dorsal view—mandibles excluded) and falling short of hind margin by about one-fourth of their length; flagellum about one-half longer than scape; the first segment as long as second to fourth taken together; apical one about as long as four preceding ones taken together; remaining segments as wide as or wider than long. Eyes about one-fourth the length of the head (dorsal view—excluding mandibles) and situated in front of middle of sides. Maxillary palp five-segmented, labial palp three-segmented.

Alitrunk as in *A. meridionalis*, about three-eighths longer than wide over pronotum, sutures clearly indicated. Scale of petiole much more reduced, about as long as wide and about as high as long or slightly higher; seen from behind almost as in *A. meridionalis*. Otherwise as in latter species.

Female (Fig. 3A–B)

Somewhat damaged, both flagella broken off.

TL 3,60 mm; L 1,48 mm; HL 0,48 mm; ED 0,32 mm; LO 0,26 mm; OD 0,13 mm; CL 0,09 mm; FL 0,39 mm; SL 0,34 mm; WL 0,94 mm; MFL 0,26 mm; HFL 0,41 mm; PL 0,12 mm; CI 91,7; FI 82,1; SI 77,3; CLI 377,8; TI 53,2; PI 133,3; HFI 43,6.

Brown, legs, antennae and mandibles paler in colour, eyes black, moderately shiny. Finely and superficially punctate or reticulate-punctate, especially on legs and antennae. Pubescence and pilosity as in worker, except for some pilose hairs on scutellum.

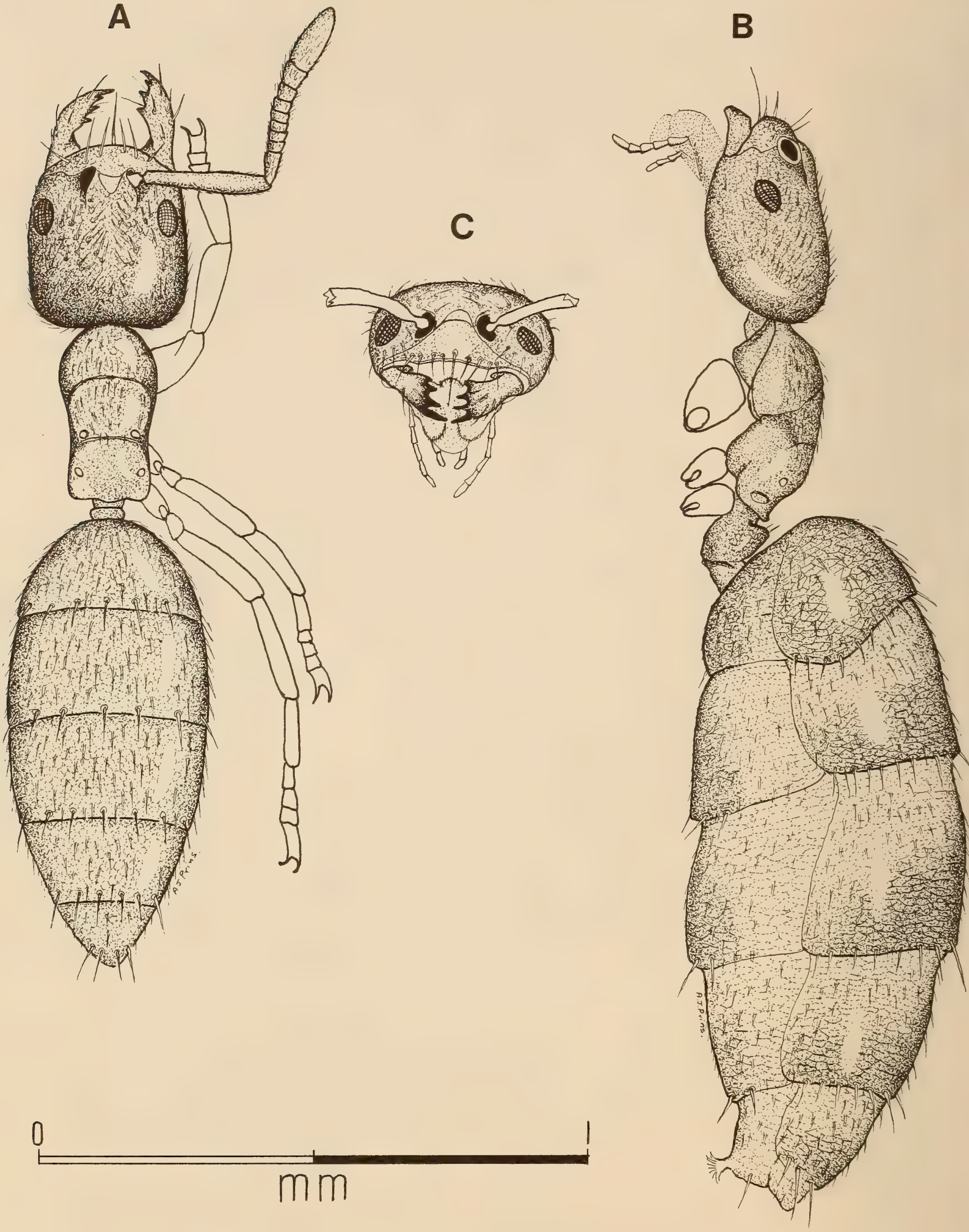

Fig. 2. *Agraulomyrmex wilsoni* sp. nov.
A. Dorsal view of worker. B. Left lateral view of worker. C. Head of worker seen from the front.

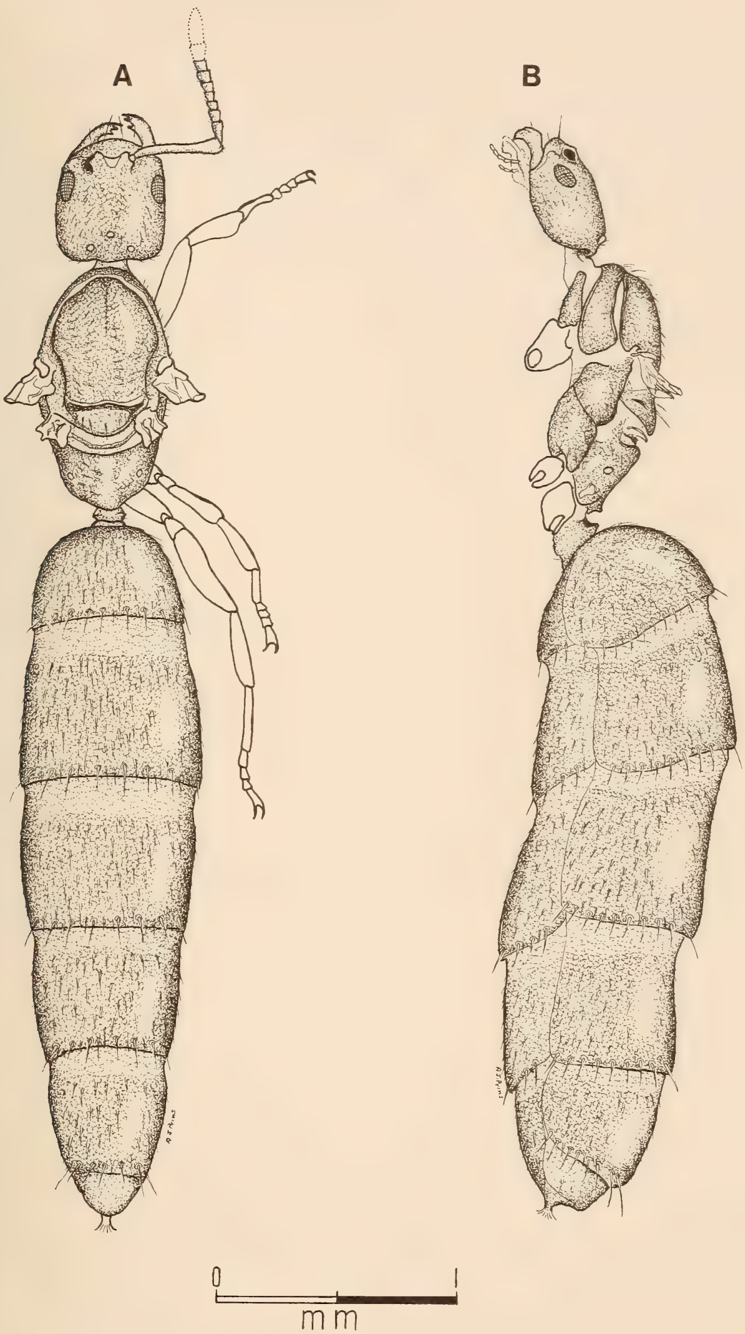

Fig. 3. *Agraulomyrmex wilsoni* sp. nov.
A. Dorsal view of female. B. Left lateral view of female.

Head quadrate in dorsal view, nearly one-sixth longer than wide, and slightly narrower than truncus; sides and hind margin almost straight. Frontal carinae, fontal area, mandibles, and clypeus as in worker. Eyes large, occupying about one-fourth the length of the head (dorsal view—mandibles excluded). Scapes about three-fourths as long as head (dorsal view—mandibles excluded) and falling short of hind margin by about the length of the second segment of flagellum.

Alitrunk slightly less than twice as long as wide, parapsidal furrows indicated, scutellum one-fourth the length of the scutum; seen from above alitrunk appears oval in outline; in profile propodeum slopes down fairly steeply towards junction of petiole. Latter with almost obsolete scale which is slightly wider than long and about one-fourth higher than wide. Abdomen in specimen examined nearly twice as long as head and alitrunk taken together, oval at base. Legs moderately long, femora somewhat swollen.

These ants are much smaller than *A. meridionalis*, much paler in colour, and more repletes were present.

Holotype

1 ☿, Gwebi, Zimbabwe (17°40′S 30°40′E), collected by K. J. Wilson December 1972, South African Museum specimen.

Paratypes

1 ♀, 7 ☿☿, as above, South African Museum specimens.

Derivation of name

This species has been named after Dr K. J. Wilson of the Ministry of Agriculture, Harare, Zimbabwe (formerly Salisbury, Rhodesia), who collected the sample.

KEY TO THE WORKERS OF THE GENERA OF THE SUBFAMILY FORMICINAE IN SOUTHERN AFRICA

Bolton's (1973) key should be altered as follows to accommodate the genera of the southern African subregion (south of the Zambesi River). According to his key the acidopore is not borne on a conical projection of the hypopygium in the genus *Camponotus,* and the orifice is usually not surrounded by a fringe of hairs. However, in some of our southern African species the acidopore is raised to a certain extent above the surface of the hypopygium on a somewhat conical area, and is surrounded by hairs on at least the anterior edge of the orifice. This is particularly the case in some species of the subgenera, *Myrmespera, Mayria* (see Prins 1973), *Orthonotomyrmex, Myrmopsamma, Myrmopiromis*, and even in some members of *Tanaemyrmex*. It is definitely on a conical projection of the hypopygium in this new genus *Agraulomyrmex*.

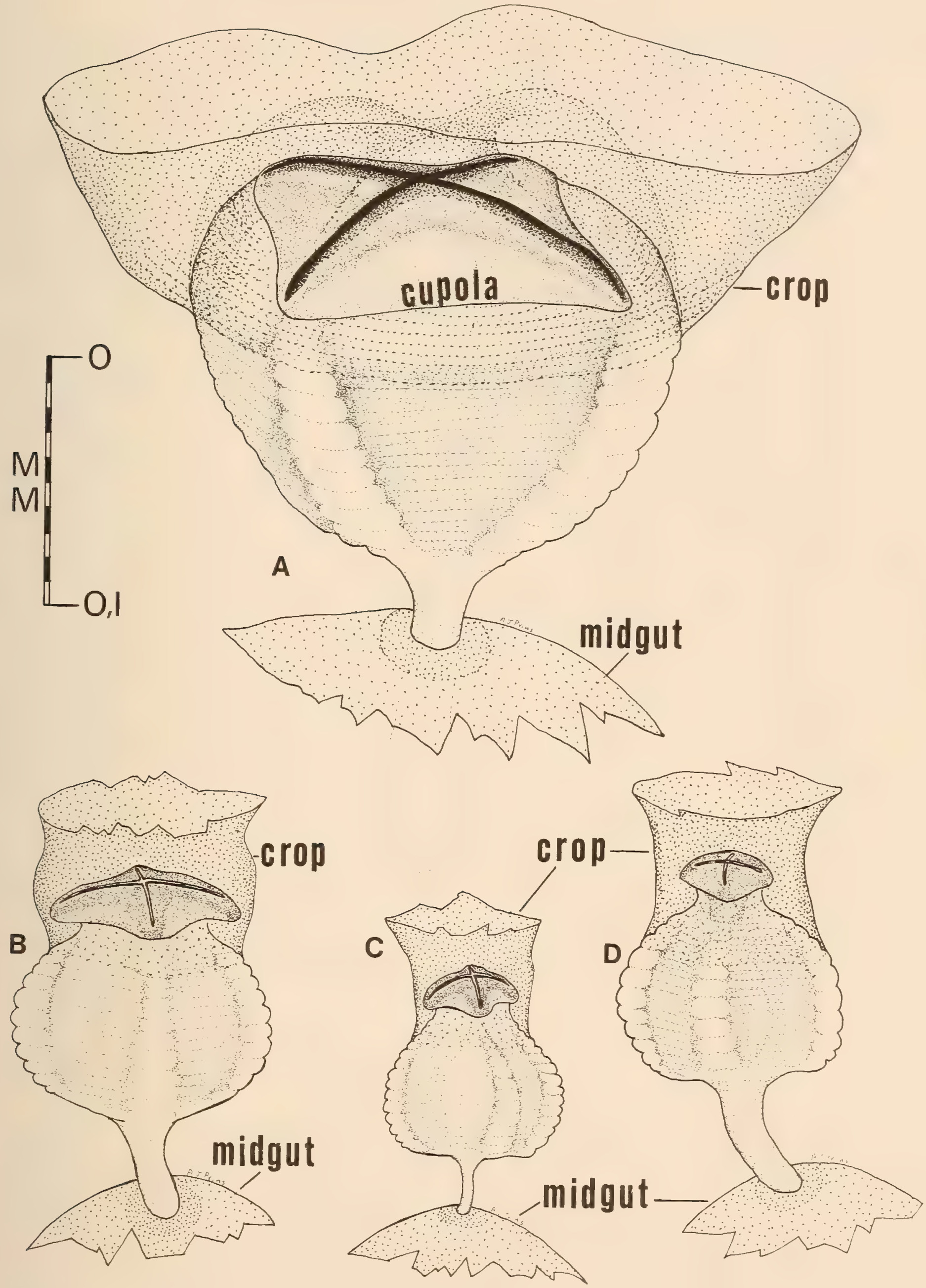

Fig. 4. Lateral view of the proventriculus of the workers of three species of plagiolepidine ants, compared with that of *Agraulomyrmex meridionalis* sp. nov.
A. *Anoplolepis steingroeveri* Forel. B. *Acantholepis capensis* Mayr.
C. *Agraulomyrmex meridionalis* sp. nov. D. *Acropyga arnoldi* Santschi.

1. Antennae 9- or 10-segmented 2
— Antennae 11- or 12-segmented 3
2. Antennae 9-segmented .... *Aphomomyrmex*
— Antennae 10-segmented .... *Agraulomyrmex*
3. Antennae 11-segmented 4
— Antennae 12-segmented 7
4. Maxillary palp 6-segmented, labial palp 4-segmented. Eyes distinct and fairly large; ocelli may be present 5
— Maxillary palp 4- or 5-segmented, labial palp 3-segmented. Eyes minute .... *Acropyga*
5. Propodeum bidentate or bituberculate; petiole usually bispinose or bidentate above, occasionally only with upper border strongly emarginate .... *Acantholepis*
— Propodeum unarmed; petiole neither armed nor deeply emarginate above 6
6. Metanotum small, much less than half as long as the mesonotum, the mesometanotal suture feeble or obsolete, at least in the minor workers. Propodeum slightly to strongly convex and often higher than the mesometanotum .... *Anoplolepis*
— Metanotum at least half as long as the mesonotum. Metanotum usually fairly prominent and separated from the mesonotum and propodeum by fairly distinct sutures. Propodeum about as high as or sometimes higher than metanotum .... *Plagiolepis*
7. Petiole reduced to an elongate, low node, allowing the gaster to be reflexed over the alitrunk. Mandibles elongate triangular, broad, apical tooth long. Maxillary palp 5-segmented, labial palp 4-segmented .... *Oecophylla*
— Petiole a node or scale, never as above; mandibles not as above. Maxillary palp 6-segmented, labial palp 4-segmented, or the palp formula rarely reduced to 3,4 or 3,3, but never 5,4 8
8. Antennal insertions very close to, or contiguous with, the posterior clypeal margin. Acidopore borne on a conical projection of the hypopygium, forming a nozzle, the orifice surrounded by a fringe of hairs 9
— Antennal insertions some distance (usually greater than basal width of scape) behind the posterior clypeal margin. Acidopore either not borne on a conical projection, the orifice not surrounded by a fringe of hairs, or orifice borne on a conical projection or raised above level of hypopygium on a somewhat conical area, without a fringe of hairs or with at least some hairs on ventral edge; or the acidopore hidden by a projection of the pygidium 10
9. Dorsum of alitrunk with very coarse setae arranged in distinct pairs. Eyes at or in front of midlength of the head .... *Paratrechina*
— Dorsum of alitrunk with fine setae, not definitely paired. Eyes placed behind midlength of the head .... *Prenolepis*
10. Anterodorsal pronotal angles usually projecting as spines or teeth, at least strongly marginate. Propodeum usually bispinose or bidentate; petiole with sharp angles, spines or teeth above. Monomorphic .... *Polyrhachis*
— Anterodorsal pronotal angles rounded, unarmed. Propodeum unarmed although may be truncate posteriorly. Petiole a node or scale, never with teeth or spines. Polymorphic .... *Camponotus*

ACKNOWLEDGEMENTS

I should like to thank Dr A. J. Hesse, formerly of the South African Museum, for his comments as well as Dr V. B. Whitehead and Miss M. Macpherson, of the same Museum, for their advice. I should also like to thank Prof. H. J. R. Dürr, of the University of Stellenbosch, for identifying the aphid *Hyadaphis coriandri* (Das).

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Prins, A. J. 1982. Review of *Anoplolepis* with reference to male genitalia, and notes on *Acropyga* (Hymenoptera, Formicidae). *Ann. S. Afr. Mus.* **89**: 215–246.

ABBREVIATIONS

CI	cephalic index (head width/HL × 100)
CL	clypeal length
CLI	clypeal index (clypeal width/CL × 100)
ED	distance between compound eyes
FI	frontal index
FL	frontal length
HFI	hind femur index (HFL/WL × 100)
HFL	hind femur length
HL	head length
L	length of anterior margin of clypeus to base of abdomen
MFL	middle femur length
PI	petiolar index (petiolar width/PL × 100)
PL	petiolar length
SI	scape index (SL/head width × 100)
SL	scape length
TI	thoracic index (thoracic width/WL × 100)
TL	total length of body
WL	length of alitrunk

6. SYSTEMATIC papers must conform to the *International code of zoological nomenclature* (particularly Articles 22 and 51).

Names of new taxa, combinations, synonyms, etc., when used for the first time, must be followed by the appropriate Latin (not English) abbreviation, e.g. gen. nov., sp. nov., comb. nov., syn. nov., etc.

An author's name when cited must follow the name of the taxon without intervening punctuation and not be abbreviated; if the year is added, a comma must separate author's name and year. The author's name (and date, if cited) must be placed in parentheses if a species or subspecies is transferred from its original genus. The name of a subsequent user of a scientific name must be separated from the scientific name by a colon.

Synonymy arrangement should be according to chronology of names, i.e. all published scientific names by which the species previously has been designated are listed in chronological order, with all references to that name following in chronological order, e.g.:

Family **Nuculanidae**

Nuculana* (*Lembulus*) *bicuspidata (Gould, 1845)

Figs 14–15A

Nucula (*Leda*) *bicuspidata* Gould, 1845: 37.
Leda plicifera A. Adams, 1856: 50.
Laeda bicuspidata Hanley, 1859: 118, pl. 228 (fig. 73). Sowerby, 1871: pl. 2 (fig. 8a–b).
Nucula largillierti Philippi, 1861: 87.
Leda bicuspidata: Nicklès, 1950: 163, fig. 301; 1955: 110. Barnard, 1964: 234, figs 8–9.

Note punctuation in the above example:
comma separates author's name and year
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In describing new species, one specimen must be designated as the holotype; other specimens mentioned in the original description are to be designated paratypes; additional material not regarded as paratypes should be listed separately. The complete data (registration number, depository, description of specimen, locality, collector, date) of the holotype and paratypes must be recorded, e.g.:

Holotype
SAM–A13535 in the South African Museum, Cape Town. Adult female from mid-tide region, King's Beach Port Elizabeth (33°51′S 25°39′E), collected by A. Smith, 15 January 1973.

Note standard form of writing South African Museum registration numbers and date.

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Capital initial letters

(a) The Figures, Maps and Tables of the paper when referred to in the text
e.g. '. . . the Figure depicting *C. namacolus* . . .'; '. . . in *C. namacolus* (Fig. 10) . . .'

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Roman numerals should be converted to arabic, except when forming part of the title of a book or article, such as
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Specific name must not stand alone, but be preceded by the generic name or its abbreviation to initial capital letter, provided the same generic name is used consecutively.

Name of new genus or species is not to be included in the title: it should be included in the abstract, counter to Recommendation 23 of the Code, to meet the requirements of Biological Abstracts.

A. J. PRINS

A NEW ANT GENUS FROM SOUTHERN AFRICA (HYMENOPTERA, FORMICIDAE)

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FISCHER, P.-H., DUVAL, M. & RAFFY, A. 1933. Études sur les échanges respiratoires des littorines. *Archs Zool. exp. gén.* **74**: 627–634.
KOHN, A. J. 1960*a*. Ecological notes on *Conus* (Mollusca: Gastropoda) in the Trincomalee region of Ceylon. *Ann. Mag. nat. Hist.* (13) **2**: 309–320.
KOHN, A. J. 1960*b*. Spawning behaviour, egg masses and larval development in *Conus* from the Indian Ocean. *Bull. Bingham oceanogr. Coll.* **17** (4): 1–51.
THIELE, J. 1910. Mollusca: B. Polyplacophora, Gastropoda marina, Bivalvia. *In:* SCHULTZE, L. *Zoologische und anthropologische Ergebnisse einer Forschungsreise im westlichen und zentralen Süd-Afrika* **4**: 269–270. Jena: Fischer. *Denkschr. med.-naturw. Ges. Jena* **16**: 269–270.

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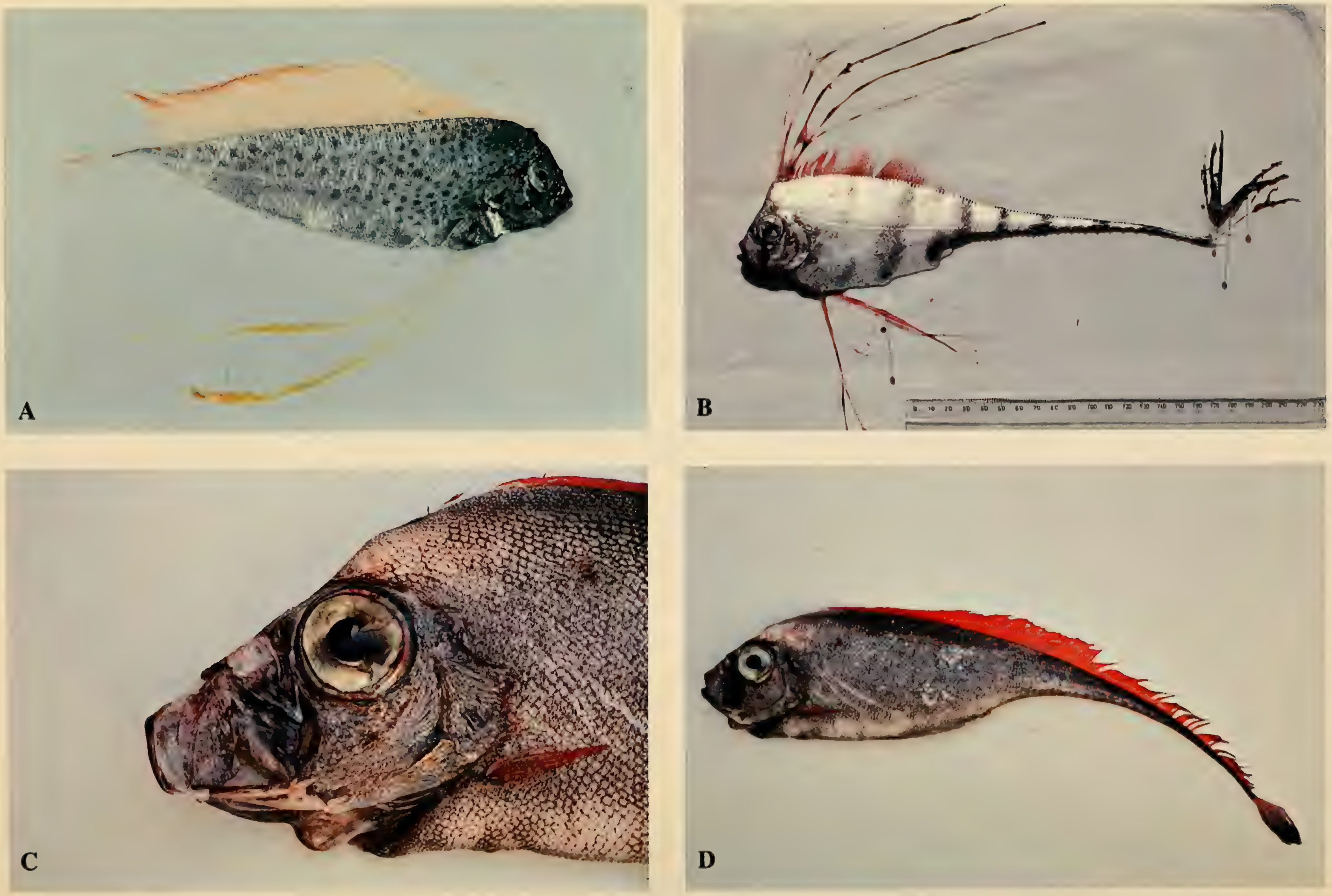

Fig. 1. A. *Desmodema polystictum* (Ogilby, 1897). Prejuvenile, SAM–27786, 96 mm SL.
B. *Zu cristatus* (Bonelli, 1820). Prejuvenile, SAM–27679, 248 mm SL.
C, D. *Zu cristatus* (Bonelli, 1820). Adult, RUSI 13352, 950 mm SL.

ANNALS OF THE SOUTH AFRICAN MUSEUM

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THE FAMILIES TRACHIPTERIDAE AND RADIICEPHALIDAE (PISCES, LAMPRIFORMES) AND A NEW SPECIES OF *ZU* FROM SOUTH AFRICA

By

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&

S. X. KANNEMEYER

Cape Town Kaapstad

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THE FAMILIES TRACHIPTERIDAE AND RADIICEPHALIDAE (PISCES, LAMPRIFORMES) AND A NEW SPECIES OF *ZU* FROM SOUTH AFRICA

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(With 11 figures and 2 tables)

[*MS accepted 26 October 1983*]

ABSTRACT

The trachipterid fishes of South Africa comprise five species: *Trachipterus trachypterus* (Gmelin, 1789), *T. jacksonensis* (Ramsay, 1881), *Desmodema polystictum* (Ogilby, 1897), *Zu cristatus* (Bonelli, 1820), and a new species *Zu elongatus*. *T. nigrifrons* Smith, 1956, is considered a synonym of *T. jacksonensis*, and *T. woodi* Smith, 1953, appears to be a synonym of *D. polystictum*. *Zu elongatus* sp. nov. is described from four specimens (including two adults) from off the western Cape Province. It differs from *Zu cristatus* in body depth, size of eye, number of lateral-line scales and vertebral counts. *Zu elongatus* probably also occurs in New Zealand. The rare adult stage of *Zu cristatus* is described from a specimen captured off Kenya. Observations on a juvenile specimen of *Zu* swimming in the ocean are reported for the first time. A juvenile specimen of *Radiicephalus elongatus* Osório, 1917 (the first South African record for this species) is also described.

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INTRODUCTION

As part of the research being done for a forthcoming revision of J. L. B. Smith's (1953) book *The sea fishes of southern Africa*, the trachipterid fishes of the J. L. B. Smith Institute were examined. In comparing specimens at the South

Ann. S. Afr. Mus. **94** (2), 1984: 13–39, 11 figs, 2 tables.

African Museum with the meagre data from the material in the Smith Institute, the second author (S. X. K.) discovered a new species of the genus *Zu*. The first South African record of the related family Radiicephalidae is based on a juvenile specimen recently collected in an Engels trawl 70 miles south-west of Cape Point.

METHODS

All measurements are from point to point, and those from the front of the snout were taken from the premaxillary symphysis with the upper jaw retracted. Standard length (SL) is measured from the front of the snout to the base of the upper caudal fin rays. Snout to vent distance (SV) is from the front of the snout to the anus. Head length is from the front of the snout to the posterior margin of the gill cavity. Snout length is from the front of the snout to the anterior margin of the orbit. Lower jaw length is from the anterior tip of that jaw to the posterior end of the articular bone. Maxilla width is the greatest width of the maxilla. The anteriormost vertebra with a haemal spine is considered the first caudal vertebra. Body depth is the greatest depth of the body. Pre-anal vertebrae are those anterior to a vertical line through the anus. Vertebral counts were made from radiographs or from cleared and stained material. Lateral-line counts begin with the scale just above the opercle and stop at the end of the vertebral column.

In the lists of material examined, abbreviations are as follows:

BMNH British Museum (Natural History)
NMNZ National Museum of New Zealand
RUSI J. L. B. Smith Institute of Ichthyology
SAM South African Museum
SIO Scripps Institute of Oceanography
USNM US National Museum of Natural History

Family **Trachipteridae**

Diagnosis

Body elongate, more or less compressed. Dorsal fin origin above or slightly behind eye; lateral edges of dorsal fin rays with minute spines or prickles (conspicuous in prejuveniles but less obvious in adults). Ventral rays of caudal fin reduced (rudimentary or absent in some species); pelvic fins rudimentary or absent in adults; in prejuveniles the pelvic fin rays are elongate and the first ray bears a row of prickles; anal fin absent. Upper jaw highly protrusile. Posterior vertebrae of adults elongate, two to four times longer than tenth vertebra; ribs absent. Ink sac absent; swim-bladder rudimentary. Skin of adults with bony or cartilaginous tubercles and pierced by numerous pores; lateral line with cartilaginous or bony plates.

Remarks

The monotypic family Radiicephalidae was redefined by Harrisson & Palmer (1968); the remaining families and genera of the suborder Trachipteroidei have

been reviewed by Walters & Fitch (1960). The trachipterid species of the northeast Atlantic and Mediterranean were revised by Palmer (1961), and those of the eastern Pacific were treated by Fitch (1964).

Like the related oar-fish (family Regalecidae), the trachipterids are members of the off-shore epipelagic community (Parin 1968). They have been observed swimming in a head-up position by means of undulations of the dorsal fin (Nishimura & Hirosaka 1964). The peculiar skin tubercles and pore system are thought to reduce drag when the fish is swimming (Walters 1963). Three genera are recognized. Although more than thirty species have been described, there are probably fewer than ten valid species in this family.

KEY TO GENERA OF FAMILY TRACHIPTERIDAE

1*a* Caudal fin comprises 4–10 dorsal rays approximately parallel to the long axis of the body; ventral caudal rays absent; no elongate spiny plates or bony tubercles along ventral edge of tail .... *Desmodema*

1*b* Caudal fin of two parts: 6–12 dorsal rays usually set at a steep angle to the long axis of the body and 1–5 ventral rays (rudimentary spiny nubbins in *Trachipterus* and adult specimens of *Zu*); elongate spiny plates or bony tubercles along ventral edge of tail 2

2*a* Lateral line runs along ventral edge of tail as a zigzag series of elongate spiny plates; subadults (less than 700 mm SL) with ventral edge of body distinctly scalloped; body depth 1,5–2,9 in SV .... *Zu*

2*b* Lateral line straight, well above ventral edge of tail in adults (specimens more than 1 500 mm SL); ventral edge of tail in adults with bony tubercles but no elongate spiny plates; ventral edge of body straight; body depth 3,7–4,1 in SV .... *Trachipterus*

Genus *Desmodema* Walters & Fitch, 1960

Diagnosis

Seven dorsal pterygiophores before first neural spine; no predorsal bones; caudal fin on same horizontal axis as caudal peduncle, comprising 4–10 dorsal rays; ventral caudal rays absent; tail greatly elongated in juveniles and adults; ventral body profile of prejuveniles (specimens less than 100 mm SV) not scalloped. Prejuveniles silvery, with numerous round dark spots.

Remarks

This genus was recently revised by Rosenblatt & Butler (1977). They recognize two species. *D. lorum* Rosenblatt & Butler, 1977, is known only from the North Pacific.

Desmodema polystictum (Ogilby, 1897)

Fig. 1A

Trachipterus jacksoniensis polystictus Ogilby, 1897: 649.
Trachipterus sp.: Smith, 1949: 504, fig. 264b.
Trachipterus woodi Smith, 1953: 504, fig. 264b; 1966: 83, pl. 15 (fig. A).
Trachypterus woodi: King & Ikehara, 1956: 22, fig. 5.
Desmodema polystictum: Rosenblatt & Butler, 1977: 848, figs 1–4.
(See Rosenblatt & Butler (1977) for additional synonyms and references.)

Material

Holotype of *T. woodi* Smith, RUSI 133, SV 89 mm (rear end of tail missing); Xora River mouth, Transkei.

SIO 75–139, SL 100 mm, SV 72 mm; 10°00′N 119°00′W; midwater trawl; 0–50 m.

SAM–27786, SL 96 mm, SV 68 mm; found in a tidal pool at Simon's Town, False Bay, Cape Peninsula.

USNM 164171, SL 113 mm, SV 78 mm; 04°41′N 159°53′W (radiograph only seen).

Diagnosis

This diagnosis is according to Rosenblatt & Butler 1977, plus data from specimens mentioned above.

Dorsal fin rays 120–128; pectoral fin rays 12–14; caudal fin rays 7–10; gill-rakers 2–3 + 9–10. Vertebrae: 71–74 total, 18–20 precaudal, 37–42 pre-anal. Eye diameter greater than snout length. Tail greatly elongated in adults; SV about two-thirds SL in prejuveniles and one-third SL in adults.

Remarks

Smith (1966) gave an amended, amplified description of the holotype of *T. woodi*. The following data not supplied by Smith are added here. SV 89 mm, body depth at pelvic fin origin 33 mm, head length 24 mm, eye diameter 10,1 mm, snout length 7,0 mm, maxilla width 6,0 mm, lower jaw length 10,6 mm. All the pelvic fin rays have been broken off at the base, but there seem to be 7 nubbins on the left side and 8 on the right. Because of the poorly ossified bones of this small specimen (perhaps made worse by preservation in formalin), it is difficult to get a clear radiograph. The anterior dorsal fin pterygiophores in relation to the first neural spine and the transition from precaudal to caudal vertebrae cannot be discerned, but the number of pre-anal vertebrae is clearly 41.

Data from the SAM specimen are as follows: SL 96 mm; SV 68 mm; dorsal fin rays 128, first five rays elongate, the longest is 37 % SL; pectoral rays 13; pelvic rays 9, elongate, reaching caudal fin; caudal rays 8; gill-rakers 3 + 9; lateral-line scales 158, each plate with a single spine except fifteenth, which has a double spine; anus asymmetrical, on left side 1,5 mm above ventral edge of body. Vertebrae: precaudal 20, pre-anal 37, total 74.

Comparison of the holotype of *T. woodi* with one of the prejuvenile specimens of *D. polystictum* examined by Rosenblatt & Butler (1977) revealed no significant differences between these two specimens. *T. woodi* is therefore considered a synonym of *D. polystictum*. The possibility of *T. woodi* being a synonym of *D. polystictum* and the record of *T. woodi* from the Pacific (King & Ikehara 1956) were apparently overlooked by Rosenblatt & Butler (1977).

Distribution

South Africa, Australia, Japan, eastern Pacific and western Atlantic.

Genus *Trachipterus* Goüan, 1770

Diagnosis

Body depth of adults 3,7–4,4 in SV, not greatly constricted behind vent. Ventral edge of body straight, with enlarged pointed tubercles. Lateral-line plates of adults more or less fused to form an almost continuous tube with rudimentary blunt spines; prejuveniles and juveniles with separate, oval lateral-line plates, each with a central, well-defined spine. In adults the lateral line runs well above the ventral edge of the tail, but in smaller specimens the lateral line runs fairly close to the ventral edge of the tail along the rear half of the tail. Dorsal and pelvic fin rays of prejuvenile stage without series of bulbous or leaf-like appendages; first five or six dorsal rays, pelvic and caudal rays elongate in prejuveniles and juveniles. Dorsal caudal rays well developed, set at steep angle to horizontal axis of peduncle. One pterygiophore before first neural spine, and 8 or 9 between first and second neural spines. Scales absent.

KEY TO SOUTH AFRICAN SPECIES OF *TRACHIPTERUS*

1*a* Pectoral fin rays 8–11; eye diameter 1,4–1,6 in lower jaw length; tubercles small and indistinct except along ventral edge of body and tail, not arranged in rows along each side of dorsal fin pterygiophores .... *T. trachypterus*

1*b* Pectoral fin rays 13 or 14; eye 1,9–2,2 in lower jaw length; tubercles distinct, those along ventral edge of body and tail larger, pointed and slightly curved; tubercles arranged in rows along each side of dorsal fin pterygiophores .... *T. jacksonensis*

Trachipterus jacksonensis (Ramsay, 1881)

Figs 2–3

Regalaecus jacksonensis Ramsay, 1881: 631, pl. 20.
Trachipterus jacksonensis: McCulloch, in Whitley, 1927: 296, pl. 25 (fig. 2).
Trachipterus nigrifrons Smith, 1956: 449, text fig. and pl. 12; 1965: 18.

Material

Holotype of *Regalaecus jacksonensis* Ramsay, Australian Museum A9114 (radiograph only).

Holotype of *T. nigrifrons* Smith, RUSI 52, 1 210 mm total length (*fide* Smith 1956), East London.

RUSI 13128, 1 320+ mm total length; East London.

SAM–25093, 2 110 mm SL, 1 050 mm SV; trawled west of Cape Town.

SAM–26731, 1 220+ mm SL, 600 mm SV; trawled west of Cape Peninsula.

SAM–28380, 1 490 mm SL, 700 mm SV; trawled 34°31′S 17°59′E.

Diagnosis

Dorsal fin rays 166–173, the first 6 rays short and hairlike; pectoral fin rays 13 or 14; gill-rakers 3–5 + 8. Vertebrae: 81–83 total, 31–34 precaudal, 44–48 preanal. Eye diameter 1,9–2,2 in lower jaw length, 6,0–7,3 % SV. Dermal tubercles on body distinct, those along ventral margin of body and tail enlarged, pointed and slightly curved; tubercles in rows along each side of dorsal fin pterygiophores

Fig. 2. *Trachipterus jacksonensis* (Ramsay, 1881). Drawn from holotype of *T. nigrifrons* Smith, RUSI 52, 1 210 mm TL. Pectoral fin reconstructed. Arrow indicates position of anus; inset shows detail of skin tubercles from middle of tail.

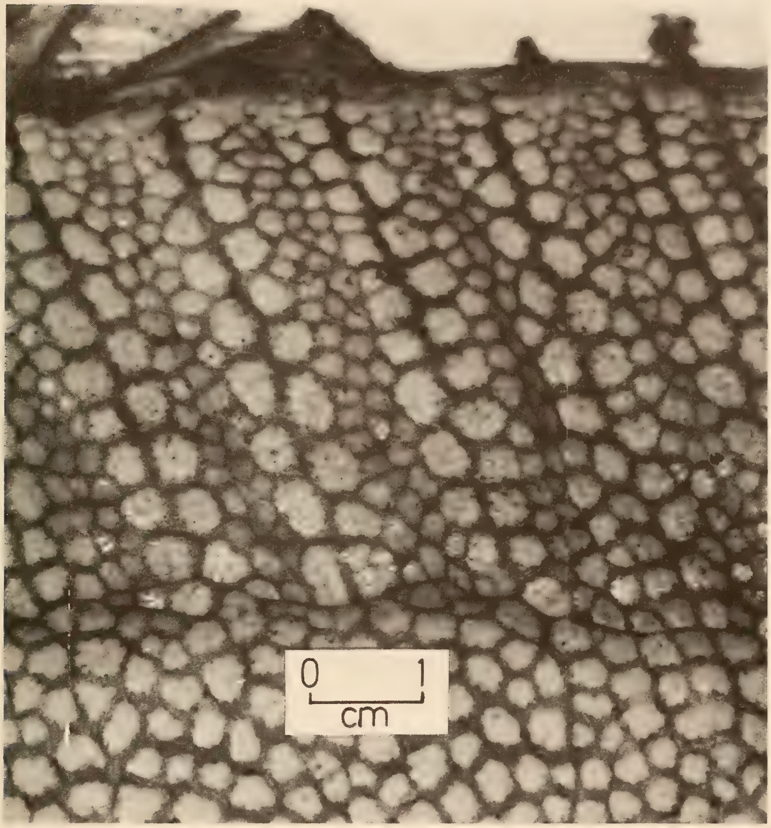

Fig. 3. *Trachipterus jacksonensis* (Ramsay, 1881). Arrangement of tubercles in vertical rows along dorsal fin pterygiophores.

(Fig. 3). Head and body silvery; front of head, interorbital area, dorsal part of upper jaw and tip of lower jaw black.

Remarks

Smith (1956) compared his new species *T. nigrifrons* with two species (*T. ishikawae* and *T. ijimae*) described by Jordan & Snyder (1901) from Japan. *T. ijimae* was synonymized with *Zu cristatus* by Fitch (1964: 231). In comparing *T. nigrifrons* and *T. ishikawae*, Smith (1956) used data from a later paper by Jordan & Snyder (1904), which is based on two non-type specimens that may or may not be conspecific with the holotype of *T. ishikawae*. In the original description of *T. ishikawae* the numbers of pectoral fin rays and gill-rakers are not given, and without having recourse to the holotype the identity of this species must remain in doubt.

Smith (1956) apparently overlooked the detailed description of *T. jacksonensis* (Ramsay, 1881) given by McCulloch (in Whitley 1927). McCulloch's

description agrees with Smith's (1956) account of *T. nigrifrons*, and McCulloch, after comparing his specimen with the holotype of *T. jacksonensis*, stated that (p. 297) 'it appears a little deeper than the holotype, to which it is exactly similar in every other detail'.

Distribution

South Africa and Australia.

Trachipterus trachypterus (Gmelin, 1789)

Fig. 4

Cepola trachyptera Gmelin, 1789: 1187.
Trachypterus arawatae Clarke, 1881: 195, text-fig.
Trachipterus jacksonensis (*non* Ramsay): Hamilton, 1916: 372, fig. 1.
Trachipterus arcticus (*non* Brünnich): Barnard 1925: 353,; pl. 14 (fig. 3); 1948: 359, fig. 17.
Trachipterus iris: Smith, 1949: 141, fig. 264.
Trachipterus trachypterus: Hamilton, 1916: 374, figs 3–6. Palmer, 1961: 342, pl. 62 (fig. 2).
(See Palmer (1973) for additional synonyms and references.)

Material

BMNH 1891.8.31.27–35, 7 specimens, North Atlantic (radiograph only seen).

RUSI 13106, 1 620+ mm SL, 710 mm SV; South Africa, no data.

SAM–11894, 540+ mm SL, 236 mm SV; South Africa, no data.

SAM–22078, 1 860 mm SL, 900 mm SV; trawled off Dassen Island (33°25′S 18°E).

SAM–23677, 113 mm SL, 82 mm SV; trawled off Slangkop, Cape Peninsula.

SAM–24024, *c.* 520 mm SL (damaged), 250 mm SV; trawled west of Cape Town.

SAM–26708, 55 mm SL, 40 mm SV; 33°06′S 16°08′E; 150–0 m; N100B plankton net.

Diagnosis

Dorsal fin rays 145–184, first 5 or 6 rays elongate in juveniles and prejuveniles, forming a dorsal pennant; pectoral rays 9–11; gill-rakers 3–5 + 10. Vertebrae: 84–96 total, 35–39 precaudal, 49–57 pre-anal. (Vertebral counts for the New Zealand specimen NMNZ 2056 are *c.* 97 total and about 42 precaudal.) Eye diameter (of adults) 1,4–1,6 in lower jaw length, 8,4–8,9 % SV. Dermal tubercles on body small, except along ventral margin of body and tail, uniformly distributed over dorsal fin pterygiophores (Fig. 4). Head and body silvery; juveniles with 3–5 dark blotches on body.

Remarks

The present specimens generally agree with Palmer's (1961) account of *T. trachypterus* (Gmelin, 1789), except that they do not have the body axis curved dorsally in the posterior caudal region, and the 540 mm SL specimen

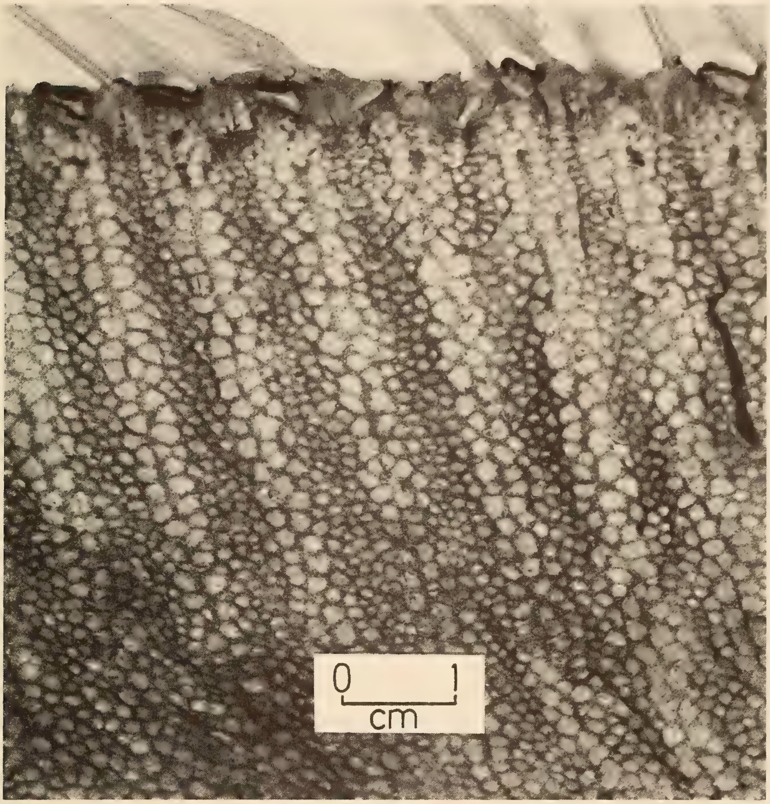

Fig. 4. *Trachipterus trachypterus* (Gmelin, 1789). Uniform arrangement of tubercles along dorsal fin pterygiophores.

(SAM–11894) seems to have the greatest body depth nearer the anus than the head, instead of just behind the head. According to Palmer (1961) *T. trachypterus* differs from *T. arcticus* in the dorsally curved tail and in having the greatest body depth immediately behind the head; in *T. arcticus*, the tail is straight and the greatest body depth is '$\frac{1}{4}$ to $\frac{1}{3}$ of the way along its length, except in specimens of less than 300 mm'.

The original description of *Cepola trachyptera* Gmelin, 1789, is inadequate to distinguish which species Gmelin was trying to describe: '*C. capite declivi, maxilla utraque fornicata, pinnis aculeatis serratis scabris. Habitat in mari adriatico, linea laterali recta, squamarum serie simplici; an secundum Forsterum proprium genus?*' (*Cepola* with downward-sloping head [i.e. steep forehead], maxilla arched on either side, fins rough [with] saw-like prickles. Habitat in Adriatic Sea, lateral line straight, scales in a single row; according to Forster it may belong in a genus of its own.)

C. trachyptera was the third species of *Cepola* listed by Gmelin (1789: 1186–1187); the first two (*C. taenia* and *C. rubescens*) are considered synonyms of

C. macrophthalma (Linnaeus, 1758). By his placement of *trachyptera* in Linnaeus's genus *Cepola*, Gmelin probably recognized at least a superficial similarity between his new species and *C. macrophthalma*. Hence it seems reasonable to suppose that *C. trachyptera* was an elongate fish with a markedly compressed body and a dorsal fin that ran the length of the body. The steep forehead rules out trichiurids.

Except for trachipterids, the only Adriatic fishes with an elongate compressed body, steep forehead, and long dorsal fin are the oarfish *Regalecus glesne* Ascanius, 1772, and *Lophotus lacepedei* Giorna, 1809. The statement about the fins '*pinnis aculeatis serratis scabris*' apparently refers to the row of minute spines or prickles along the lateral edges of the dorsal fin rays of trachipterid fishes. The species name *trachyptera* means 'rough fin', being derived from the Greek words *trachys* (= rough) and *pteron* (= wing or fin). These fin-ray prickles are lacking in the oarfishes but very conspicuous in juvenile trachipterids.

We are left, then, with *Trachipterus trachypterus* (*sensu* Palmer 1961) and *Zu cristatus* as the Adriatic species that best fit the description given by Gmelin. Because of its greater body depth (which would render the '*Cepola*' designation less likely) and the distinctive features of the prejuveniles (which are unlikely not to be noticed and mentioned in a description), *Zu cristatus* seems the less plausible of the two species. Furthermore, *T. trachypterus* is fairly common in the Adriatic Sea (Jardas 1980).

By a process of elimination together with a few assumptions, we have come to the conclusion that *Cepola trachyptera* Gmelin is the species currently recognized as *Trachipterus trachypterus*.

Hamilton (1916) published descriptions of seven specimens of trachipterids from New Zealand. The specimen from Nelson, South Island, that he illustrated (fig. 2) from his original sketch was doubtfully assigned to *T. jacksonensis*. This specimen, later illustrated by Whitley (1968: 46, fig. 1) under the name '*Desmodema arawatae*', appears to be *Zu elongatus* sp. nov. Judging from the count of eleven pectoral fin rays given for five of the specimens, Hamilton's other specimens appear to be *T. trachypterus*. Hamilton identified his largest, 'approximately 6 ft' specimen with *T. jacksonensis* because it had smooth dorsal fin rays, instead of 'all rays spinous, and having a spiny tubercle at the base' for his juvenile specimens of *T. trachypterus*. Hamilton assumed that the minute spinules or granulations on the dorsal fin rays of juveniles were a good specific character, and were not lost or greatly reduced with growth. However, this is precisely what happens with all trachipterids. In our adult specimens of *Trachipterus* and *Zu* the spinules are absent or very much reduced, compared with those of juveniles.

Distribution

Mediterranean Sea, eastern Atlantic to South Africa, Japan and New Zealand.

Genus *Zu* Walters & Fitch, 1960

Diagnosis

Young with pelvic and anterior 6 dorsal fin rays greatly elongated, bearing serially arranged, membranous flaps (Figs 1D, 8). One pterygiophore before first neural spine, and 8 or 9 between first and second neural spines. Scales present, though very deciduous, and not apparent in prejuveniles. Body depth 1,7–2,8 in SV, more or less constricted behind anus. Ventral edge of body distinctly scalloped in specimens less than 700 mm SL; belly of specimens more than 800 mm SL nearly straight, but with a low fleshy keel from pelvic fin rudiments to anus. Lateral line drops to ventral edge of tail shortly behind anus, from where it runs as a zigzag series of elongate spiny plates to base of caudal fin and is then continued on to the ventral caudal filament (of prejuveniles) as a straight tube. Total vertebrae 63–69 or 84–87.

KEY TO SPECIES OF *ZU*

1*a* Body depth 12–16% SL; prejuveniles with body not abruptly constricted behind vent; eye 9–10% SV; lateral-line plates 126–130 .... *Z. elongatus* sp. nov.
1*b* Body depth 20–26% SL; prejuveniles with body abruptly constricted behind vent; eye 13–16% SV; lateral-line plates 99–106 .... *Z. cristatus*

Zu cristatus (Bonelli, 1820)

Figs 1B–D, 5–8

Trachypterus cristatus Bonelli, 1820: 487. Smith, 1949*a*: 99; 1949*b*: 142, fig. 264a. Dieuzeide *et al.*, 1954: 151, figs. Tortonese, 1958: 1. Parin *et al.*, 1978: 176.
Gymnetrus repandus Metaxà, 1833: 53, fig. 7.
Trachypterus bonelli Valenciennes, in Cuvier & Valenciennes, 1835: 331.
Gymnetrus müllerianus Risso, 1840: 13, pl. 125.
Trachypterus repandus: Costa, 1842: 11, pl.
Trachypterus semiophorus Bleeker, 1868: 279, pl. XII. Weber & de Beaufort, 1929: 89.
Trachypterus iris (*non* Walbaum): de Buen, 1917: 23, fig.
Trachypterus gavardi Bounhiol, in Bounhiol & Gavard, 1923: 1.
Trachypterus ijimae Jordan & Snyder, 1901: 311, pl. 17 (fig. 9). Tanaka, 1915: 358, pl. 96 (fig. 301). Bolin, 1933: 35. Okada & Suzuki, 1956: 168, fig. 1. Lindberg & Legeza, 1965: 298.
Zu cristatus: Walters & Fitch, 1960: 445. Palmer, 1961: 346. Fitch, 1964: 229, fig. 1. Backus *et al.*, 1965: 139, fig. 2. Ibáñez & Gallego, 1974: 523, fig. 1. Karrer, 1975: 72. Fitch & Schultz, 1978: 89, fig. 5. Parin *et al.*, 1978: 176. Oliver, 1982: 60, figs 1–2.
(See Palmer (1973) for additional references.)

Material

RUSI 7185, 2 specimens: 64 mm SL, 31 mm SV; 204 mm SL, 90 mm SV; South Africa, no data.

RUSI 7187, 232 mm SL, 106 mm SV; Algoa Bay, eastern Cape Province.

RUSI 7188, 173 mm SL, 77 mm SV; Kariega River mouth, 33°36′S 26°42′E.

RUSI 13352, 950 mm SL, 450 mm SV; off Mombasa, Kenya.

SAM–24522, 415 mm SL, 170 mm SV; off Slangkop lighthouse, Cape Peninsula, Cape Province.

SAM–27679, 248 mm SL, 107 mm SV; 28°23,5′S 32°41,9′E.

Fig. 5. *Zu cristatus* (Bonelli, 1820). Prejuvenile, SAM-27679. Scales on tail.

Fig. 6. *Zu cristatus* (Bonelli, 1820). Prejuvenile, SAM–27679. Scales partially covering bases of lateral line plates.

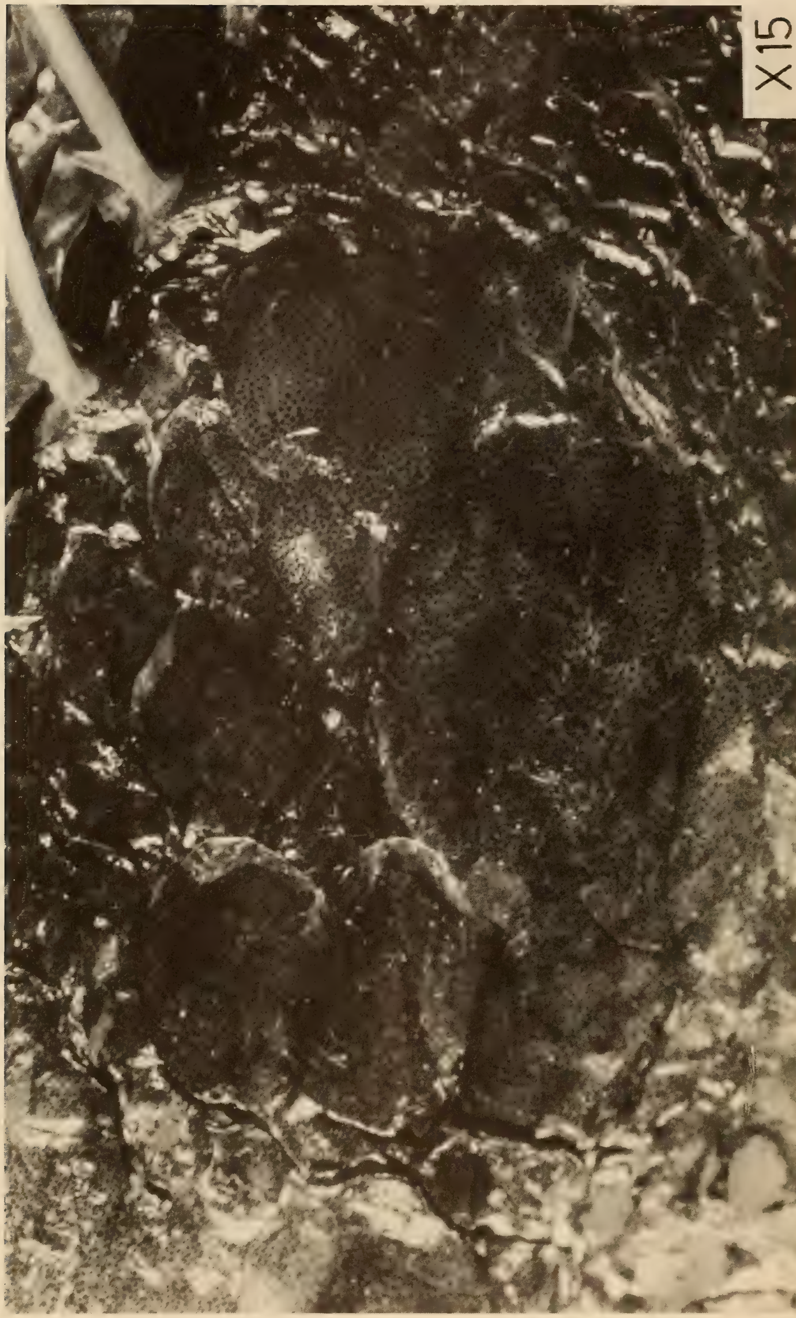

Fig. 7. *Zu cristatus* (Bonelli, 1820). Prejuvenile, SAM–27679. Shiny patches of very thin scales with pigment attached, situated just behind anus.

Diagnosis

D 120–150; P 10–12; V 5–7 (absent in adults); dorsal caudal fin rays 6–12, set at a steep angle to horizontal axis of caudal peduncle; ventral caudal rays represented by spiny nubbins in adult; prejuveniles with 1–5 ventral caudal rays, with 1 or 2 produced into long filaments. Gill-rakers 2–3 + 8–9. Lateral-line plates 99–106; lateral line begins above middle of eye and continues beyond the vertebral column on to the caudal fin between the second and third ventral caudal rays (about 16 pored scales on the caudal membrane of SAM–27679). Vertebrae: 63– 69 total, 22–24 precaudal, 32 pre-anal. SV 41–48 % SL; body depth 20–26 % SL; eye diameter 1,3–1,7 in length of lower jaw, 13–16 % SV. Young silvery, with about 6 wavy dark vertical bars on dorsal part of body and 4 on ventral part; tail with about 6 complete black bars; caudal fin mostly blackish, proximal part pale. Adults silvery grey, paler ventrally; dorsal fin scarlet; caudal fin reddish black, darker distally.

Description of adult (RUSI 13352, 950 mm SL)

D 145; P 11; dorsal caudal fin rays 9; gill-rakers 3 + 8. Body robust (not nearly as compressed as adults of *Trachipterus* or *Zu elongatus* sp. nov.), with fleshy keel along belly; body covered with small, very deciduous, thin, cycloid scales. (All scales on body are missing, but the scale pockets are distinct; a few scales were left on the tail near the lateral line.) Lateral line curving gradually from above opercle to ventral edge of tail 100 mm behind anus; lateral-line scales spiny, represented by two rows of staggered spiny scutes along ventral part of tail. Pelvic fins represented by a few nubbins. Single nostril on each side of snout. Pseudo-branch well developed. Pyloric caeca very numerous. Swim-bladder not apparent.

Measurements for six specimens are given in Table 1.

Table 1

Measurements (in mm) of specimens of *Zu cristatus*.

	RUSI 7185	RUSI 7187	RUSI 7188	RUSI 13352	SAM 24522	SAM 27679
Standard length (SL)	205	232	173	950	415	248
Snout to vent (SV)	91	108	76	451	170	107
Greatest body depth	49	56	43	223	84	64
Body depth at anus	19	21	18	123	41	23
Head length	31	—	27	161	60	37
Eye diameter	12	14	10	69	21	14
Maxilla width	6,3	7,3	5,8	32	13	9
Lower jaw length	19	22	16	92	36	23

Remarks

Adults of *Zu cristatus* are apparently rarely captured; only four specimens longer than 800 mm SL have been reported (Bolin 1933; Tortonese 1958; Ibáñez & Gallego 1974; Fitch & Schultz 1978). Judging from the illustration of a 610 mm

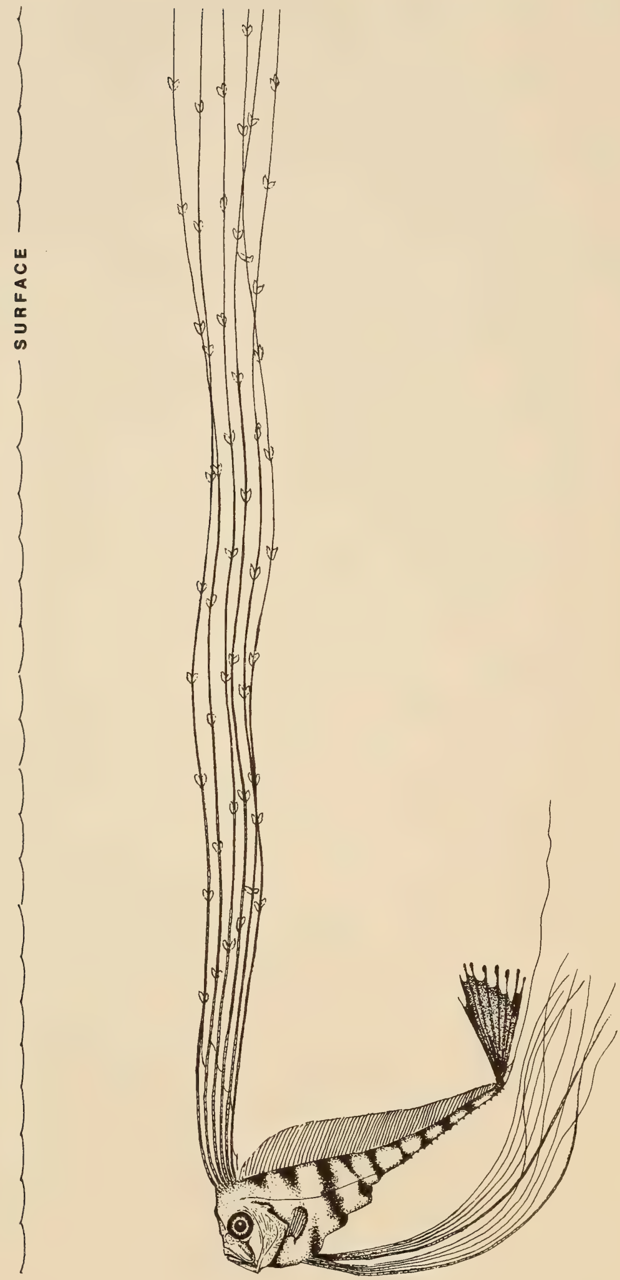

Fig. 8. *Zu cristatus* (Bonelli, 1820). About 100 mm in length. Drawing of a live juvenile swimming in ocean (based on a sketch by Len Jones).

prejuvenile by Tortonese (1970, fig. 190b), metamorphosis takes place in the 600–800 mm size range. The small prejuveniles that we have examined (64–248 mm SL) are much more compressed than the adults. The pelvic fins and elongated anterior dorsal fin rays are lost during the transition from prejuvenile to juvenile stage.

Despite previous reports of deciduous cycloid scales on specimens of *Zu cristatus* (Bolin 1933; Tortonese 1958; Walters & Fitch 1960; Palmer 1961; Fitch 1964), Rosenblatt & Butler (1977) discounted these observations, because they could not find scales on their eight specimens (27,5–811 mm SL). As noted above, adults of *Zu* do have scales but the epidermis is very fragile, and there are only a few scales remaining on the tail of the 950 mm SL specimen. On the 248 mm SL prejuvenile (SAM–27679), the scales are most apparent along the tail (Fig. 5), which they appear to cover completely, and continue on to the caudal fin rays. Some of the bases of the lateral-line plates are partially covered by scales (Fig. 6). The lateral surface of the tail just behind the anus has scales that seem to have pigment attached to them. These scales are apparent on the fish as large shiny patches (Fig. 7). The scales forming these shiny patches are exceedingly thin, but will separate on being lifted with a fine needle. There is evidence of squamation over the entire body area, particularly ventrolaterally where many scaled areas remain intact. The head does not appear to have scales.

Except for the report of Nishimura & Hirosaka (1964) of a large *Trachipterus* specimen in a relatively small aquarium, there have been no published observations on live trachipterids. In view of the dearth of such reports, the following observations of L. Jones of Fynnlands, Natal are of considerable interest. Judging from Jones's sketch, the specimen that he observed was probably *Zu cristatus*.

'I was swimming just beyond the surf-line in 20 feet of water when I noticed what at first appeared to be a small fish caught by a stinging plankton or jellyfish some 6–10 inches below the surface. On closer examination I found it to be a fish with long thread-like fins: . . . a small silvery fish with big head and eye, with red-brown markings, about $3\frac{1}{2}$ inches long. The six [elongated] anterior dorsal rays were at least 15 inches long, with what appeared to be pairs of tiny brown leaf-like appendages set $1\frac{1}{2}$ to 2 inches apart down the length of each dorsal ray. Its pelvics were also very long, about the same length as the body, but I can't remember if the "leaves" were present on these or not. Its tail was all but invisible, but the dorsal fin seemed to be part of its propulsive mechanism (the lower or rear part that is) for it swam in a head-up-tail-down manner which I have drawn for you' (Fig. 8).

Zu elongatus sp. nov.

Figs 9A–11B

? *Trachipterus jacksonensis* (*non* Ramsay): Hamilton, 1916: 374, fig. 2.
Trachipterus jacksoniensis (*non* Ramsay): Phillipps, 1944: 120, pl. 52. (Unjustified emendation.)
Trachypterus arcticus (*non* Brünnich): McCann, 1953: 5 (figs 5–6 only).
? *Desmodema arawatae* (*non* Clarke): Whitley, 1968: 45, fig. 1.

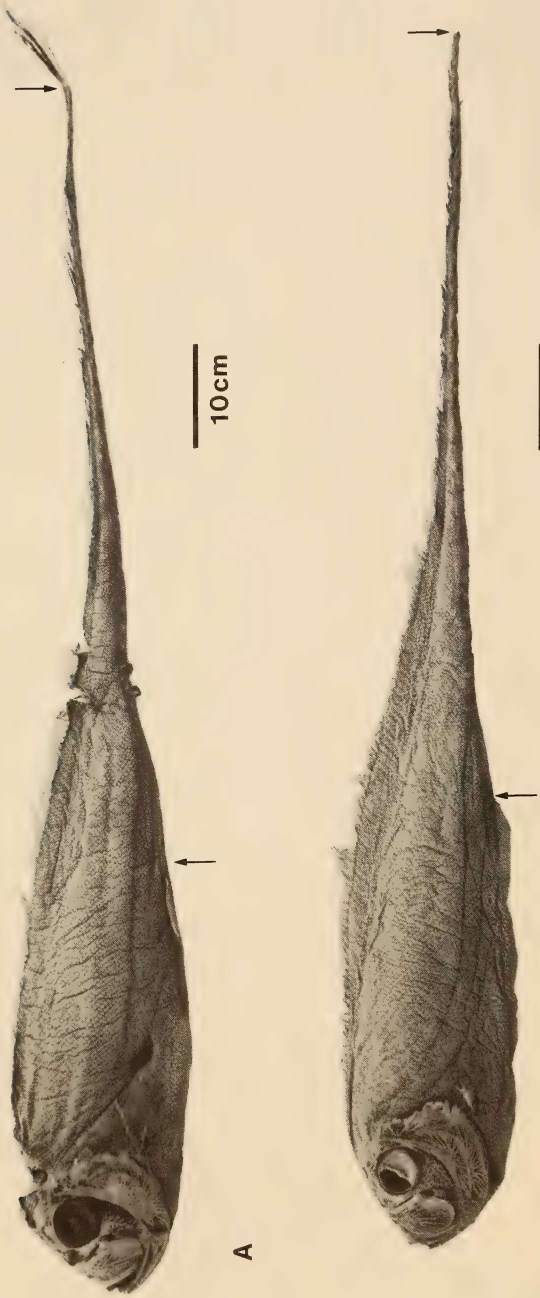

Fig. 9. A. *Zu elongatus* sp. nov. Holotype, adult, SAM–24704, 1 166 mm SL. B. *Zu elongatus* sp. nov. Paratype, adult, SAM–29392, 1 135 mm SL. Arrows indicate position of anus and base of caudal rays.

Holotype

SAM–24704, 1 166 mm SL, 404 mm SV; adult, ?♂. Trawled south-west by west of Cape Columbine, north-western Cape Province; bottom depth 411 m; donated by Captain Jacoby, S. T. *Rochea*; collected 22 November 1965.

Paratypes

SAM–29392, 1 135 mm SL, 421 mm SV; adult, ?♂. Trawled west of Cape Town by Irvin & Johnson Ltd trawler; depth and date of collection unknown.

SAM–19870, 630+ mm SL (part of tail missing), 228 mm SV; juvenile. Trawled north-west of Table Bay by trawler of Irvin & Johnson Ltd; bottom depth 580 m; collected in 1946, exact date unknown.

SAM–24414, 480 mm SL (upper jaw fully protracted), 166 mm SV; prejuvenile. Trawled off Cape Columbine, north-western Cape Province; bottom depth 548 m. Collected and donated by P. Henry, Midwest Fisheries Ltd, Cape Town, 1 February 1965.

Other material

SAM–29396, 1 123 mm SL, 421 mm SV; adult, badly damaged; no data.
NMNZ P.834, *c.* 425 mm SL, 138 mm SV; French Pass, New Zealand.
NMNZ P.2248, 315 mm SL, 108 mm SV; Awanui, New Zealand.

Diagnosis

D 142–147; P 11–12; V 7, elongate in young, absent in adults; C 17 (12 dorsal rays and 5 ventral rays of which 2 may be represented by tiny spines). Gill-rakers 2–3 + 7–9. Lateral-line plates 127–130. Vertebrae: 84–87 total, 29–31 precaudal, 38–40 pre-anal. SV 34–37% SL; body depth 12–16% SL; eye 9–10% SV. Teeth: 9–21 in upper jaw, 6–9 in lower law; adults with 2 vomerine teeth; palatine teeth present or absent. Dermal tubercles and pore system present at all stages; scale pockets well developed in adults (Fig. 10).

Description (measurements in Table 2)

Adult (holotype, 1 166 mm SL; Fig. 9A)

Body laterally compressed, tapering gradually to the elongate tail; dorsal body profile convex, the ventral profile irregular; fleshy keel along ventral midline of belly. Body, tail, and cheeks covered with tubercles and conspicuous pores; scale pockets distinct; tubercles on cheek enlarged.

D 143, the posterior rays long, filamentous; P 11; pelvic fins absent, represented by bony ridge within a slit-like pocket; 2 of the 5 ventral caudal fin rays are small rudimentary spines; the other caudal rays elongate, the longest 160 mm. Gill-rakers 3 + 8; lateral-line plates *c.* 128. Teeth: upper jaw with 10 on right side of symphysis, 11 on left side; lower jaw with 6 teeth on right side of symphysis and 3 on left side; 2 teeth on vomer, 3 teeth on right palatine, 2 teeth on left palatine.

Colour in alcohol: body tan, interspersed with paler tubercles; front of head with triangular dark area, extending on to lips and gular region; posterior dorsal fin rays black; caudal fin black except for a small, pale area proximally.

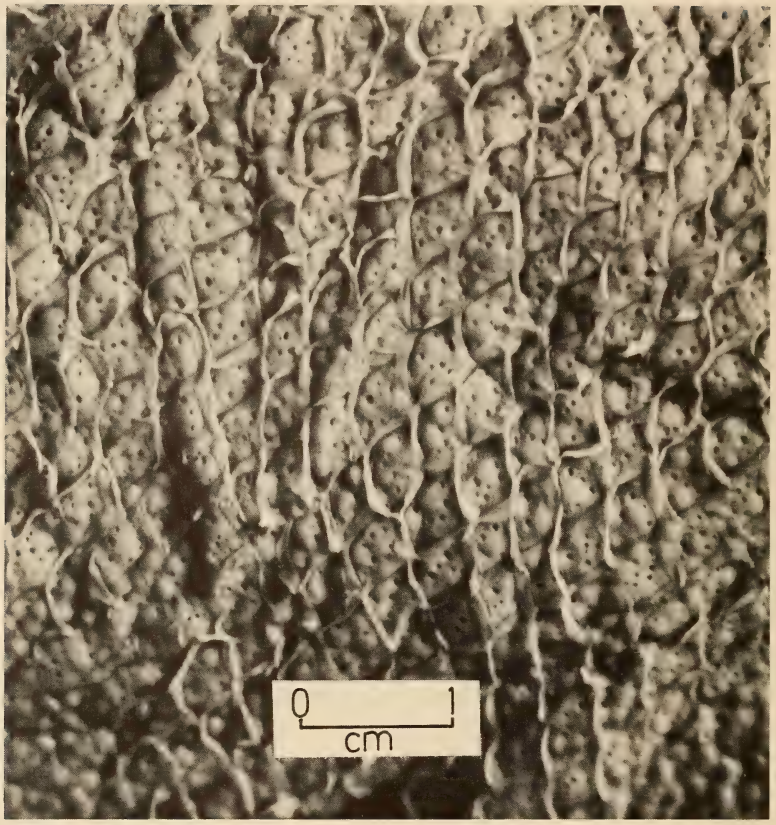

Fig. 10. *Zu elongatus* sp. nov. Paratype, adult, SAM–29392, 1 135 mm SL. Scale pockets.

TABLE 2

Measurements (in mm) of specimens of *Zu elongatus* sp. nov. Specimen SAM–24414 was fixed with the upper jaw completely protracted and the head is somewhat damaged, consequently the measurements SL, SV and head length are approximate estimates of what they would be with the upper jaw retracted. Both eyes are also missing on this specimen.

	Holotype	Paratypes			
SAM Catalogue No.	24704	19870	24414	29392	29396
Standard length (SL)	1166	627+	460	1135	1123
Snout to vent (SV)	404	228	154	421	421
Greatest body depth	177	99	63	177	176
Body depth at anus	133	66	34	121	137
Head length	137	81	66	134	135
Eye diameter	41	21	—	42	42
Maxilla width	33	16	13	33	36
Lower jaw length	73	42	34	74	80

Prejuvenile (480 mm SL; Fig. 11A)

Body elongate, laterally compressed, gradually tapering to caudal fin, not abruptly constricted behind vent; dorsal profile of body convex; ventral profile anterior to anus strongly scalloped, with three well-defined ventral lobes. The strong upward curve of the tail, characteristic of prejuveniles in *Zu cristatus*, is not apparent in this specimen. Lateral line curving gradually from above opercle to ventral margin of tail 30 mm behind anus. Body surface abraded; no scales or scale pockets apparent.

D 147, the first 6 rays elongate; P 11; pelvic fins elongate; caudal directed upward, the rays elongate (longest 170 mm). Gill-rakers 3 + 8–9; lateral-line plates *c*. 127. Teeth: upper jaw with 8 on right side of symphysis, 10 on left side; 4 on each side of lower jaw symphysis; no teeth on palatines or vomer.

Colour in alcohol: three incomplete dark cross-bars on body; five dark bars on tail. Triangular dark area above and extending across symphysis of upper jaw; dusky area across lower jaw symphysis, extending on to gular region. Distal part of caudal fin dark; some dorsal fin rays with traces of dark pigment.

Juvenile (630+ mm SL; Fig. 11B)

Body shape as for prejuvenile; ventral lobes smaller and less distinct. Caudal fin missing; anterior dorsal rays and pelvic fins elongate. Dermal tubercles on cheek enlarged; scale pockets visible at 40 × magnification.

D 137; P 12; gill-rakers 2–3 + 7; lateral-line plates *c*. 130. Teeth: upper jaw with 7 on right side of symphysis, 4 on left side; lower jaw with 2 teeth on right side and 4 on left; 2 teeth on vomer and 1 on right palatine.

Colour in alcohol: six dark cross-bars on tail; symphysis of lower jaw dark. Body abraded, with no other pigmented areas apparent.

Paratype SAM–29392, 1 135 mm SL (Fig. 9B), differs from the holotype SAM–24704, 1 166 mm SL and from the other adult, SAM–29396, 1 123 mm SL, in that it lacks palatine teeth. SAM–29396 has only 9 teeth in the upper jaw. However, the teeth in *Zu elongatus* are easily detached and since SAM–29396 is a badly damaged specimen some teeth might have been lost.

Remarks

As denoted by the name, *Zu elongatus* is more elongate than *Zu cristatus* (body depth 12–16% SL, versus 20–26% SL). Other differences between these two specimens are the size of the eye (9–10% SV in *Zu elongatus*, 13–16% SV in *Zu cristatus*), number of the lateral-line plates (126–130 in *Zu elongatus*, 99–106 in South African specimens of *Zu cristatus*, but 114–118 reported by Fitch (1964) for eastern Pacific material), and vertebral counts (84–87 total, 29–31 precaudal, 38–40 pre-anal for *Zu elongatus*; 63–69 total, 22–24 precaudal, 32 pre-anal for *Zu cristatus*). Palmer (1961) and Fitch (1964) give counts of 64–65 and 63 for total vertebrae of *Zu cristatus* from the eastern Atlantic and eastern Pacific. The ranges of vertebral counts for South African specimens given above are from 6 specimens of *Zu cristatus* and 5 of *Zu elongatus*.

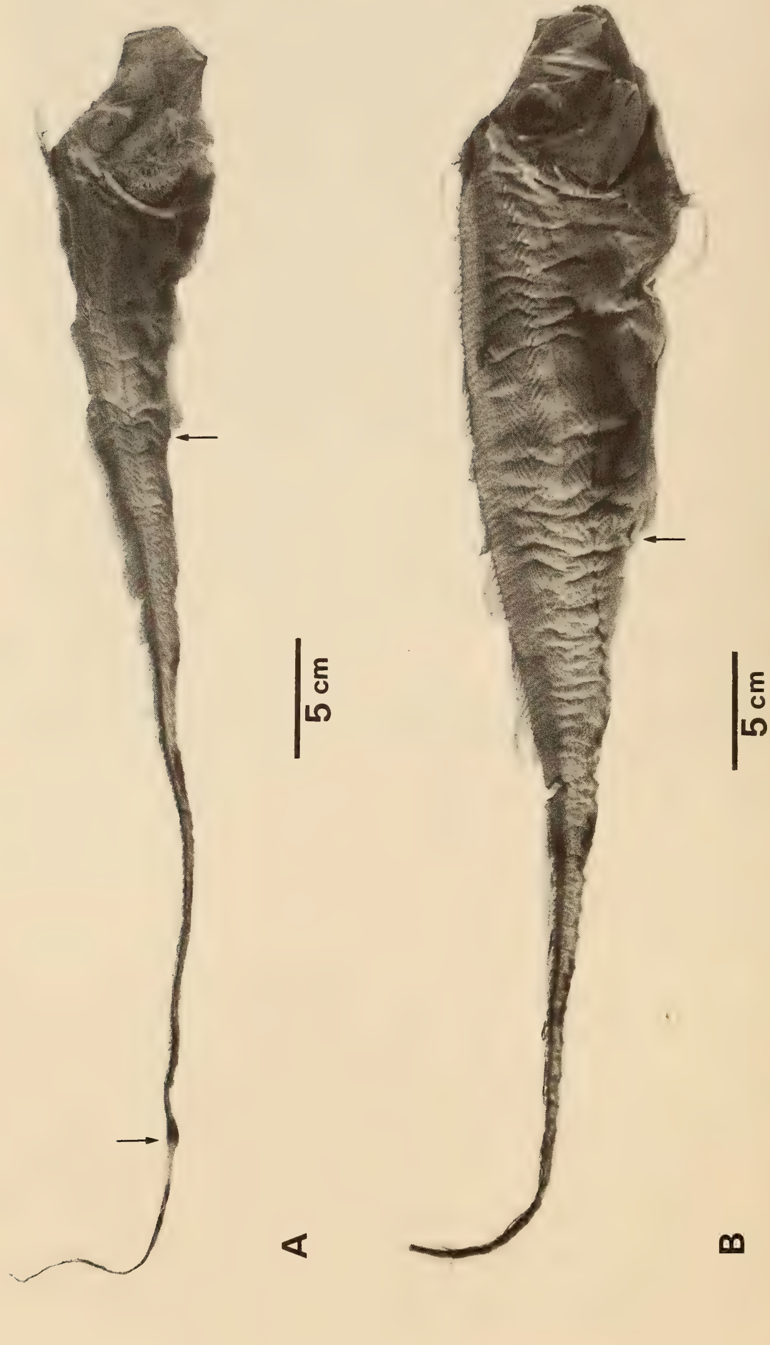

Fig. 11. A. *Zu elongatus* sp. nov. Paratype, prejuvenile, SAM–24414, 480 mm SL. B. *Zu elongatus* sp. nov. Paratype, juvenile, SAM–19870, 630+ mm SL. Arrows indicate position of anus and base of caudal rays.

Fitch (1964) recognized *Trachipterus semiophorus* Bleeker (described from Indonesia) and *T. ijimae* Jordan & Snyder (from Japan) as synonyms of *Zu cristatus*. All the other synonyms of *Zu cristatus* are based on specimens from the Mediterranean Sea, and all the recognizable published descriptions and illustrations of *Zu* from the Mediterranean are of *Zu cristatus*. It seems, therefore, that *Zu elongatus* does not occur in the Mediterranean Sea.

The specimen described and figured by Whitley (1968: 45, fig. 1, as '*Desmodema arawatae*') is the same one reported by Hamilton (1916) from Nelson, South Island, New Zealand as '*Trachipterus jacksonensis* Ramsay?'. This fish appears to be *Zu elongatus*. The measurements given by Whitley (1968: 45), as well as his figure, show the body depth to be 16 per cent of the standard length (which is within the range for *Zu elongatus*, but not for *Zu cristatus*). We have examined the specimen from French Pass, Cook Strait, reported (as *Trachipterus jacksoniensis*) by Phillipps (1944) and (as *Trachypterus arcticus*) by McCann (1953). Data from this specimen (NMNZ P.834) plus one other from New Zealand (NMNZ P.2248) are not included in the diagnosis or description of *Zu elongatus* given above. Counts and measurements from this New Zealand material are as follows (P.834 given first): SL *c*. 425 (tip of tail separated from rest of specimen), 315; SV 138, 108; greatest body depth 66, 48; body depth at anus 34, 22; head length 53, 43; eye diameter 15, 14; lower jaw length 31, 25. Lateral-line scales 125, 131; pectoral-fin rays 12, 12; dorsal-fin rays, damaged, 6+132; total vertebrae *c*. 88, 88; pre-anal vertebrae 39, 37; and precaudal vertebrae 32, 30.

Family **Radiicephalidae**

Diagnosis

Body elongate, strongly compressed, the depth decreasing gradually from just behind head to last vertebra. Dorsal fin origin over eye. Anus well before midpoint of body. Anal fin rudimentary, located about half-way between anus and last vertebra. Pelvic fins rudimentary in adults, with 6–9(?) rays in juveniles. Lateral line continued beyond last vertebra where the canals of either side are joined to form a large, thin-walled tube carried on the greatly elongated 'rays' that emanate from the ventral surface of the last three vertebrae. Length of posterior vertebrae less than twice that of tenth vertebra. Upper jaw highly protrusile. Skin with scattered soft papillae and numerous pores. Swim-bladder well developed; ribs and ink-sac present.

Radiicephalus elongatus Osório, 1917

Radiicephalus elongatus Osório, 1917: 114, figs 2–4. Walters, 1963: 456. Harrisson & Palmer, 1968: 185, figs 1–6. Palmer, 1973: 333. Parin *et al.*, 1974: 116, fig. 13. Karrer, 1976: 179, pl. 1, text-fig. 1. Parin, 1978: 163. Parin *et al.*, 1978: 176.

Material

SAM–29416, *c*. 310 mm SL (upper jaw protracted), 420 mm TL; 70 miles south-west of Cape Point; 600 m; Engels midwater trawl; collected by the South African Sea Fisheries Institute, 24 May 1982.

Description (measurements in mm)

Body and tail elongate, strongly compressed. SL *c*. 310; body depth at pectoral fin base 32, at anus 24,3, and at anal fin origin 11,0; body width at pectoral base 7,5; SV *c*. 124; snout to anal fin *c*. 188; pelvic fins to vertical at rear end of pectoral base 20,5; from pelvic fins to anus 44, from anus to anal fin 67; head length *c*. 51; orbit diameter *c*. 13; interorbital width 8; lower jaw length 26; maxilla width 10,3.

Dorsal fin with 160 rays, the origin above the eyes, the last ray over the twenty-sixth preural centrum; pectoral fin rays 10 (including the short, spine-like first ray), the longest ray 10 mm; pelvic fins damaged, most of the rays broken off at their bases, which number 6 or 7; one 47 mm ray is still attached to the pelvic fin base; anal fin rays 6, the longest ray 3 mm; length of anal fin base 3 mm. Gill-rakers 3 + 8, the upper rudimentary, the anteriormost very short; branchiostegal rays 4 + 3 (left side with 4 + 2 rays, but the membrane is torn and one ray has probably been lost).

Lateral line begins over eye and drops to 6 mm above the anus, thence running close to the ventral edge of the tail (1 mm above anal fin base). No individual lateral-line scales apparent; the canal comprises a large, thin-walled (almost transparent) tube; at about the anal fin the tube runs along the ventral edge of the vertebral column on a shelf formed by the elongate slender haemal spines (haemal spine of eighteenth preural vertebra 12,4 mm long; centrum length 2,8 mm); posterior to the end of the vertebral column, the lateral-line tubes are carried between the dorsal and ventral caudal fin 'rays', which are 108 mm long; width of lateral-line tube at penultimate vertebra 1,0 mm and the vertical height of this centrum is 0,6 mm.

Total vertebrae 121, precaudal vertebrae 38, pre-anal 45; ribs are present on all precaudal vertebrae except the first three. Length of tenth centrum (2,2 mm) equals height of centrum at its posterior end; length of tenth preural centrum (3,2 mm) equals 4,5 times height of centrum at its posterior end.

Upper jaw with a patch of small sharp teeth plus one much larger retrorse tooth at each side of premaxillary symphysis; a series of 7–9 slender sharp teeth on each side of lower jaw symphysis; 3 slender sharp teeth on vomer and 2 or 3 similar teeth on each palatine.

Body and tail silvery in life; dorsal fin base blackish.

Remarks

The specimen described above agrees well with the 597 mm SL neotype described by Harrisson & Palmer (1968) and the 520 mm SL specimen described by Karrer (1976). The lack of countable lateral-line scales in the SAM fish may be due to the abrasion that the specimen has suffered and/or its smaller size. The difference in the number of branchiostegal rays reported by the previous authors (6 versus 7 on the right side of the SAM fish) may reflect damage to their specimens, or perhaps the fact that the anterior two rays on the epihyal are close together and might have been counted as a single ray.

The exact nature of the caudal fin 'rays' is not clear; the ventral group of two or three 'rays' seems to comprise the greatly elongated haemal spines of the last two or three preural centra. The rays above and below the lateral-line tubes are longitudinally striate, but none of these rays is segmented.

The specimen described above represents the first record of this species for the south-eastern Atlantic Ocean. *Radiicephalus elongatus* is known from the Atlantic and Pacific oceans and may also occur in the Indian Ocean.

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Nuculana (Lembulus) bicuspidata (Gould, 1845)

Figs 14–15A

Nucula (Leda) bicuspidata Gould, 1845: 37.
Leda plicifera A. Adams, 1856: 50.
Laeda bicuspidata Hanley, 1859: 118, pl. 228 (fig. 73). Sowerby, 1871: pl. 2 (fig. 8a–b).
Nucula largillierti Philippi, 1861: 87.
Leda bicuspidata: Nicklès, 1950: 163, fig. 301; 1955: 110. Barnard, 1964: 234, figs 8–9.

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P. C. HEEMSTRA & S. X. KANNEMEYER

THE FAMILIES TRACHIPTERIDAE AND RADIICEPHALIDAE (PISCES, LAMPRIFORMES) AND A NEW SPECIES OF *ZU* FROM SOUTH AFRICA

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(*continued inside back cover*)

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LOBEDU MATERIAL CULTURE

A COMPARATIVE STUDY OF THE 1930s AND THE 1970s

By

PATRICIA DAVISON

Cape Town Kaapstad

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LOBEDU MATERIAL CULTURE
A COMPARATIVE STUDY OF THE 1930s AND THE 1970s

By

Patricia Davison

South African Museum, Cape Town

(With 119 figures)

[*MS accepted 1 November 1983*]

ABSTRACT

In this museum and field study a collection made by E. J. Krige and J. D. Krige between 1936 and 1938 is described and compared with data recorded 40 years later by the author.

Within the descriptive framework, material is ordered according to three categories of resources—natural, domestic, and imported. Dependence on the indigenous environment is shown to have been important in the traditional technology and in understanding the value with which certain materials were invested. Effects on the material culture of the transition from a subsistence to a money economy are discussed. It is noted that women have proved both conservative and adaptable in changing economic circumstances and that the practice of certain crafts has increased to supply both domestic needs and an informal market. Conclusions are drawn regarding the interrelated nature of material and social change.

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INTRODUCTION

The Lobedu of the northern Transvaal have been the subject of anthropological study from the 1930s to the present. Their social structure has been described in detail (Krige 1931, 1932, 1938, 1964, 1974, 1975*a*, 1975*b*, 1975*c*, 1981; Krige & Krige 1943, 1954; Mönnig 1961, 1963) and the ethnography has provided the basis for comparative analytical studies (Leach 1961; Sansom 1974; Kuper 1975, 1982). Thus far little has been published on their material culture. The aim of this paper is to describe traditional Lobedu material culture as represented in a collection (hereafter referred to as the Krige Collection) made between 1936 and 1938 by social anthropologists E. J. and J. D. Krige, and to record changes observed 40 years later during fieldwork undertaken by the author.

The Krige Collection was made with the purpose of bringing together objects that represented the full range of the material culture of a single society at a particular time. It was built up during the course of anthropological research involving participant observation among the Lobedu people over a continuous period of nearly 18 months. In 1970 the collection, together with short notes on each item, was presented to the South African Museum, Cape Town, where it is now housed. It is primarily on the Krige Collection and notes that the description of Lobedu technology in the 1930s is based.

The collection comprises 248 specimens (SAM–9671 to 9919) and represents almost all aspects of Lobedu material culture with the exception of very large objects and immovable structures. The number of examples of each type of object, however, is not large enough to assess the range of variability. The area in which the collection was made covered most districts of the original Modjadji Location demarcated in 1892, as well as farms and Crown Land to the north and the area of the old Medingen mission station. For the purpose of this study, it is assumed that the artefacts in the collection are representative of the material culture in the 1930s unless the collector's notes state otherwise. The impression gained from the collection is essentially qualitative but the large body of related data allows the material culture to be viewed within wider social, economic, and environmental perspectives. The anthropological literature on the Lobedu provides valuable contextual data for the collection. In addition, E. J. Krige has made available unpublished photographs taken during the 1930s, and relevant unpublished data relating to her fieldwork in the 1930s and during the period 1962–1980, and has further assisted the study by providing additional information on the situation in the 1930s (Krige 1982: 1–45), which allowed a more

accurate comparison to be made with the 1970s data. Unacknowledged photographs in the text were taken by the author.

Field research undertaken in September 1973, April 1975, June 1976, and April 1978 was planned with the aims of recording in detail the technological processes used by the Lobedu and of comparing their recent material culture with that represented in the Krige Collection. A total of 3½ months was spent in the research area. It was considered important to collect data at different times of year in order to observe the productive activities associated with the seasonal cycle. As far as possible this was done, with the exception of the summer wet season. While doing fieldwork it was necessary to commute daily between the Lobedu reserve and Duiwelskloof, some 20 km away, as permission to camp in the reserve was not granted by the local magistrate. With the guidance of Simeon Modjadji, a member of the royal family living at the capital and one of the assistants of Krige & Krige, and by using the Krige Collection as a baseline record of the material culture, more was achieved in a relatively short period of fieldwork than would otherwise have been possible. Charts with the vernacular terms and photographs of all the items in the Krige Collection were used to record whether traditional artefacts were still currently in use. Frequency of occurrence was noted and absence of any item was followed up with inquiry regarding replacement by alternatives and reasons for disuse. The focus of this investigation was Modjadji's village, the capital, which has been continuously occupied for the past 70 years, as well as smaller and newer villages on the surrounding hills and in the Molototsi valley. Areas beyond the boundaries of the old Modjadji Location, the Medingen mission area and Gakgapane were not included.

Once it had been established that many of the traditional crafts, notably pottery, basketry and wood-working, were still active, the processes involved were observed and recorded during the normal work routine of the craftsmen. This was supplemented by demonstrations of particular techniques no longer in regular use but still remembered. Where possible all stages in the processes were photographed *in situ* and examples of partly made artefacts collected for further study. Specimens of raw materials were collected, and the source and availability noted; preparation of materials, tools used, and techniques employed were observed in action and confirmed in interviews with the craftsmen. Inquiry was made into specialization and the transmission of skills from generation to generation.

In the case of processes that were no longer practised, information was sought from older people who may have recalled techniques formerly used. No satisfactory information on iron-smelting was obtained as the complex technology involved seemed to have been forgotten even by the older generation. Accounts of skin-working technology were obtained mainly from people who had had past experience but no longer practised it.

Specimens from Modjadji's area in the private collections of M. Klapwijk (now part of the Transvaal Provincial Museum Service collections housed at

Eiland in the northern Transvaal) and J. Witt, both of Tzaneen, and in the collection of the National Open Air and Cultural History Museum in Pretoria were recorded and photographed to supplement the Krige Collection.

The descriptive framework adopted orders the data according to the materials utilized in the technology. The concept underlying this approach is that there is an interaction between the resources of the environment, the technical skills used in exploiting these resources, and the social context in which the technology operates. Following this framework, objects made of different materials and the related processes are described in separate sections. In reality, however, everyday activities integrate artefacts made of clay, wood, grass, gourds, and a variety of other materials. Cross-references in the text indicate where objects are used concurrently and where similar processes are applied to different materials. In conclusion the separate sections are drawn together in a discussion of change in the material culture.

Simeon Modjadji acted as interpreter throughout the study. There is no standard orthography for the Lobedu dialect, which has characteristics of both Venda and North Sotho. North Sotho is the language taught in schools. In the ethnographic literature spelling is inconsistent. For example, the bi-labial ʋ in Lobedu is inconsistently rendered as b or v. The spelling 'Lobedu' has been used as this is the standard rendering in North Sotho (E. O. J. Westphal 1982 pers. comm.). The vernacular terms have been given in *khelovhedu* dialect, spelt by using Venda for the consonants and Sotho for vowels following the advice of N. J. van Warmelo (1977 pers. comm.).

HISTORICAL OUTLINE

Oral traditions recorded by Krige & Krige (1943: 1–12) trace Lobedu history to the disintegration of the Karanga state north of the Limpopo River during the sixteenth century. The Lobedu royal line is thought to descend from one of the three great dynasties, Mwene Mutapa, Torwa, and Changamire. In the late sixteenth or early seventeenth century a break-away group migrated southward across the Limpopo (Alpers 1970: 217) taking with them the knowledge of rain-making and the sacred glass beads that were among the insignia of chieftainship. The early Lobedu moved into the Lowveld and established themselves as rulers in their present environment by subduing the previous inhabitants, thought to have been scattered groups of Sotho-speaking people. A period of internecine strife was followed in about 1800 by the accession of the first woman chief, Modjadji I, who restored political stability and achieved widespread fame and power as a rain-maker.

Lobedu oral traditions have parallels among those of the Venda who crossed the Limpopo later in the seventeenth century and also trace their ancestry to the Karanga (Stayt 1931: 12). During the post-migratory period bonds between Lobedu and Venda were strengthened through trade, marriage alliances and the Venda practice of coming to Modjadji to supplicate for rain.

Notable similarities in language, custom and material culture confirm their past association.

During the nineteenth century Modjadji's influence spread to other Sotho-speaking people living in the Lowveld, including the Letswalo, Kgaga, Thabina, and Narene. Culturally the Lobedu have much in common with these neighbouring people, as do they with the Phalaborwa people further east (Du Toit 1968; Hammond-Tooke 1981; J. D. Krige 1937). By comparison, they have little in common with Sotho-speaking people living in the different environment of the Highveld (Krige & Krige 1943: 306; Hammond-Tooke 1981: 154).

From about 1840 onward successive waves of Tsonga-speaking refugees entered the Lowveld as a result of the social disruption caused between 1835 and 1840 by the invasions of the Ndwandwe warrior Shoshangane in what is now southern Mozambique, and after 1856 by the wars of succession followed by attenuated raiding, drought, and related famine and disease. Prior to this time a few Tsonga-speaking groups had been assimilated as Modjadji's subjects but the large number of nineteenth-century immigrants who had to settle in the unhealthy low-lying areas were not absorbed through intermarriage and were regarded as outsiders. This exclusion was reflected in the refusal of Modjadji to allow implements of Tsonga manufacture or origin, such as wooden mortars for stamping maize and the tambourines used in the *malôbô* cult, to be adopted at the capital (Krige 1931: 233; Mantwa Modjadji 1981 pers. comm.; Krige 1982: 27).

During the second half of the nineteenth century expansion of the Zuid-Afrikaansche Republiek into Modjadji's territory initiated a period of conflict and fundamental change. From as early as 1855 the Volksraad imposed on chiefs in the Soutpansberg area an annual tax of five head of cattle (or five elephant tusks, or twenty-five copper rods, or twenty leopard skins) and appointed officials to exact this tax (Grimsehl 1955: 209). In 1861 Albasini, the official responsible for the Lobedu area, had cause to complain that Modjadji refused to pay the annual tax. Later that year a commando force took action against her and confiscated a large number of cattle and small livestock as penalty. In the years that followed Modjadji remained intransigent and prepared to resist further invasions of her territory (Grimsehl 1955: 205).

In 1866 the Volksraad changed the law regarding taxation so that Africans could be taxed individually and in 1876 there was a further revision according to which every male over 20 years of age was required to pay 10 shillings per year, and, in addition, a hut tax of 10 shillings per year was payable. By the same ruling it was decided that 'locations' would be assigned to the more important chiefs who would be paid a salary and be required to keep law and order, and supervise the collection of taxes (Grimsehl 1955: 206). Modjadji, however, was not prepared to co-operate and her indignation was further aroused when in 1886, before the 'location' boundaries had been fixed, the Volksraad placed 'occupation farmers' on land already occupied by her subjects. The Lobedu resisted with arms and by burning down farmers' houses and raiding cattle. In 1890 a

commando force was sent to Modjadji to exact taxes, confiscate arms, and settle the unrest in the area (for details see Grimsehl 1955: 211–221).

In 1892 the boundaries of the Modjadji Location were fixed despite strong opposition from Modjadji's councillors and headmen. The area was less than one tenth of the area that Modjadji had previously controlled. Discontent over this dispossession of land continued and eventually led to armed confrontation in 1894 when General Joubert finally crushed Lobedu resistance and confiscated about 10 000 head of cattle in retribution (Grimsehl 1955: 236–250).

During these last unsettled decades of the nineteenth century the Berlin Missionary Society established a station in Modjadji's area (Reuter 1905: 249). In 1881 Reuter founded the mission settlement at Medingen and started proselytizing among the Lobedu but with little early success. The drought of 1881–2 was attributed to the presence of the mission and Khashane, a Lobedu evangelist who was treated with great suspicion, was eventually murdered in 1884. Reuter, however, persevered in his cause, established a school, trained young men in technical skills, and interceded on behalf of the Lobedu in negotiations with the Volksraad over their territorial boundaries.

In 1895 Modjadji II followed the tradition of her ancestors in committing ritual suicide. By the end of her reign her territory had been greatly reduced and the value system that sanctioned her authority was under pressure.

In the years that followed white encroachment continued. The appropriation of resources undermined local production, as did the importation of mercantile goods. Higher taxes payable in cash and an increasing need for money to buy commodities forced men to become migrant labourers. By 1920 a railway line linked the Lowveld to the industrial centres of the Transvaal and facilitated mobility. Pass Laws, however, which had been introduced as early as 1901, restricted the movement of migrants.

One of the results of the South African War was that many Africans moved back on to the land that had previously been appropriated. None the less, pressure on arable land was high. In 1910 it was reported that 'In the vicinity of Duiwelskloof and around Modjadji's location some farms are so densely populated with squatters that it is difficult for them to find sufficient land to cultivate without interfering with white settlers' (Blue Book on Native Affairs 1910: 269). The introduction of the plough, which allowed maize to be more effectively cultivated, only partly offset the pressure on arable land as in many cases, owing to shortage of draught animals, the plough was not set deep enough to break more than the top-soil. Furthermore, use of the plough is dependent on good rainfall and suitable topography, with the result that in dry seasons and in steep areas hoe-cultivation continued.

Regulations for the dipping of cattle were received with suspicion by the Lobedu, wary of interference. Public-health measures were introduced, quinine was freely distributed but malaria remained prevalent in the low-lying areas, especially in the wet season. The annual recurrence of malaria in the Lowveld was one of the factors that discouraged white economic development of this area

until much later in the 1950s after the large-scale use of pesticides had lowered the risk of disease. During the 1930s when Krige & Krige carried out their fieldwork, the Lobedu area was still relatively isolated and despite external constraints a subsistence economy was still viable.

During the years between the mid-1930s and the mid-1970s, which are the main focus of this study, the Lowveld was opened up to far more intensive white economic exploitation as a result of the eradication of malaria and improved access with the construction of new roads. New employment opportunities were provided for blacks living in the area and more money came into the local economies. At the same time population of the rural areas increased following the implementation of influx control in urban centres. The resultant pressure on arable land made subsistence agriculture an impossibility for many living in the Lobedu area and the economy became increasingly monetized.

Also during this period political constraints increased. The Bantu Authorities Act of 1951, which provided for the establishment of tribal, regional and territorial authorities, laid the foundation for the later 'homeland' policy. Within this system the authority of the traditional chiefs, councillors and headmen is greatly circumscribed by the imposed political structure and appointed officials. The Lobedu district was included in the North Sotho homeland, Lebowa, which in 1972 was declared a self-governing area within the Republic of South Africa.

The challenge to traditional values initiated during the late nineteenth century gained in intensity during the twentieth century as the authority of the chiefs was undermined, as education facilities improved and mobility increased. In 1959 Modjadji III died naturally, having rejected the rite of suicide, and was succeeded by her daughter, Modjadji IV, who died in 1980 and was in turn succeeded by her daughter. Modjadji V is represented on the Lebowa Legislative Assembly by her brother, Legugela.

ENVIRONMENT

Modjadji's territory is situated in the foothills of the northern extension of the Drakensberg in the eastern Transvaal, at less than 1 000 m above sea level. The topography varies from relatively high mountainous areas to low-lying river valleys and plains. Climatic conditions differ considerably with topographic variation and, despite mountains and rivers, there are stretches of land with little or no water. In general the lowlands are less well watered and hotter than the highlands where the temperatures are seldom extreme. The predominant type of soil is a fertile reddish loam suitable for raising a variety of grain crops. Much of the highland area is too steep for ploughing (Hattingh 1975: 60) but well suited to terraced hoe-cultivation. Clays of different types are found in many places, mainly in river-banks, and are used extensively in the technology.

The area falls within the summer-rainfall region. The rains normally start in October and continue to March. On average January and February are the wettest months, having falls of about 150 mm. Rain is usually plentiful on the mountains but less predictable on the plains; in one season there may be good

rains in one area and drought in another. This unpredictability of rainfall was a major source of insecurity in the agricultural economy. By having fields in different areas and by planting drought-resistant sorghum as well as maize the risk of total crop failure was reduced. In times of drought wild foods formed an important component of the diet.

The natural vegetation is bushveld savannah rich in trees, shrubs, creepers, and grasses. Most of the area is of the veld type described by Acocks (1975: 27–28) as 'Lowveld sour bushveld', which provides poor-quality grazing. The hillslopes are thickly wooded including, in one place, a unique forest of cycads. A nineteenth-century traveller (Nelson 1973: 221) described Modjadji's area as 'some of the richest, wildest and most romantic scenery to be met with . . .'. The valleys have open woodland vegetation with an abundance of large trees, among which the marula and a number of *Acacia, Combretum* and *Ficus* species are prominent. Traditionally the Lobedu made extensive use of these plant resources both for food and in the manufacture of artefacts. The particular value of the marula tree is clearly reflected in the material culture and in the diet.

Oral traditions also reflect the importance of natural resources. Kruger (1936: 91) translated a vernacular account as follows: 'Now the Lobedu were looking for a nice country with fertile soil and with ant-hills. They sent the young men in advance to look for such a country. And indeed . . . they found the right country having marula-trees and ant-hills. . . .' Thus recorded are the essential elements of Lobedu subsistence, a natural vegetation rich in useful trees and wild fruits, edible insects, and fertile arable land.

By the 1940s natural timber resources had been seriously depleted, mainly through the clearing of land for fields and settlement, and legislation to protect certain indigenous trees had been introduced. Many of the trees, formerly used by the Lobedu, were affected and could no longer be cut down without payment of a fee. Dead-wood, however, continued to be used without restriction both for fire-wood and for making utensils, and illegal use of wood was not uncommon.

Formerly, when the indigenous forests and woodlands were thickly inhabited with game, hunting was an important source of meat as well as skins and horns for domestic use. Ivory, horns and skins were also of considerable economic importance in external trade through Delagoa Bay. Modjadji's territory lay just south of the rich Soutpansberg hunting-grounds known to have been exploited from the early eighteenth century by Venda and Hlengwe hunters (Wagner 1980: 324). By the mid-nineteenth century the introduction of fire-arms by white hunters had changed both the nature of hunting and the scale of exploitation.

Modjadji's territory was undoubtedly rich in game but, according to Krige (1983 pers. comm.), although the Lobedu hunted for meat, they did not play an active role in hunting for the ivory trade as did their Venda and Tsonga neighbours. In the mid-nineteenth century ivory was a common medium of exchange and Modjadji received ivory in tribute from hunters in her territory and from neighbouring chiefs such as Mawewe (Das Neves 1879: 104). Tribute brought to

Modjadji from supplicants for rain ensured that she benefited from the game trade while not actively participating. In the Lobedu context, tribute in goods had rain as its reciprocal counterpart. By the 1930s not only had the game population been drastically reduced but both hunting and the possession of fire-arms were restricted by law.

The Lowveld was subject to infestation by a number of insects that threatened both human and animal life. Malaria was prevalent in the low-lying areas, especially during the wet seasons. Tsetse fly (*Glossina* sp.) was widespread and a serious threat to cattle, which were also subject to epidemics such as east-coast fever and rinderpest. Swarms of locusts threatened crops and wild plant foods; wood-boring termites attacked structures and utensils, and grain stores had to be protected against weevils. Not all insects, however, were regarded as pests. Edible termites (*Macrotermes* sp.) formed an important part of the diet, which was also supplemented by grasshoppers.

There are some indications that prior to the alienation of grazing-land and the rinderpest, herds were relatively large, despite the presence of tsetse fly. Reuter, reporting to the Holloway Economic Commission in 1930, commented that when he came to the area in the 1880s 'the lands were lying idle but the country was full of cattle'. Not only were cattle more numerous but they were in better condition because grazing-land was plentiful. It was the rinderpest of 1896, together with lung-sickness and east-coast fever, that destroyed almost all the cattle in the area. Recovery thereafter was slow and restricted by limitations on grazing-land and the poor quality of the sourveld pasture. The small number of approximately 3 000 cattle recorded in the Lobedu reserve in 1936 (Krige 1941: 2) seems to be less related to the effects of tsetse than to the disruption of grazing-patterns brought about by the fixing of territorial boundaries.

DEMOGRAPHY

The Lobedu are a heterogeneous group of originally unrelated people who over the centuries have become linked together through a network of social relations and who now tend to conform to a common cultural pattern. The Lobedu who trace descent from the original founding group comprise less than 10 per cent of the Lobedu as a whole (Krige & Krige 1943: 85).

Before the territorial boundaries were drawn up in 1892, Modjadji was acknowledged as chief over the vast area bounded by the Great and Little Letaba rivers (Krige & Krige 1943: 13). The demarcation of the Modjadji Location (Fig. 1) in 1892 limited Modjadji's territory to approximately 17 500 morgen (179 km^2) despite complaints by Lobedu headmen to the Location Commission that this was insufficient land to support their people (Grimsehl 1955: 228–231). During the 1930s the Lobedu extended their land to approximately 389 km^2 by the purchase of farms to the north and east (Krige & Krige 1956: 12), and in the 1960s trust lands to the north were included under Lobedu jurisdiction.

In 1904–5 (Report of the Transvaal Native Administration) the population of the original Modjadji Location was 14 434, giving a mean density of

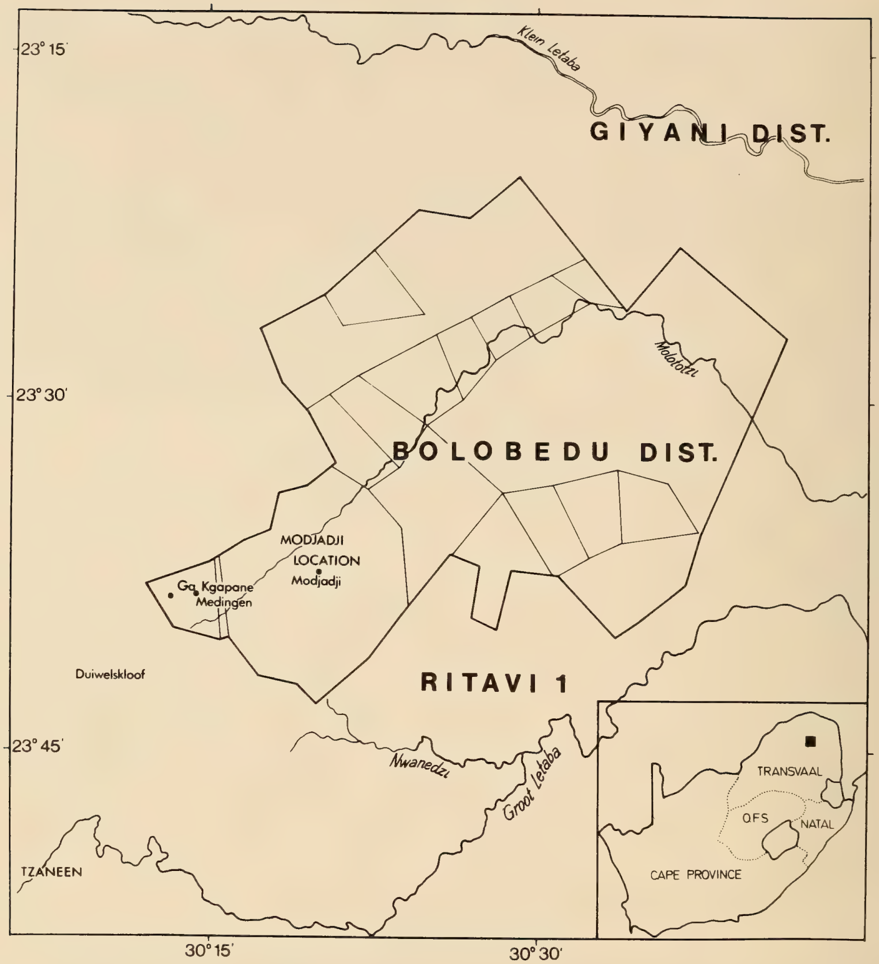


Fig. 1. Original Modjadji Location demarcated in 1892 and BoLobedu magisterial district, 1979.

81 persons/km². In 1936 the population of the extended territory was estimated at 33 000 (Krige & Krige 1943: 13) giving a mean density of 85 persons/km². By 1980, according to the official census for the BoLobedu district, the population had risen to 116 643, and the average density was well over 200 persons/km². In areas of most concentrated settlement the density is considerably higher. The resultant shortage of arable land has led to an inevitable move from agriculture to dependence on wage labour.

In the late 1970s over 65 per cent of males were migrant labourers and absent from the reserve at any one time, compared to 37 per cent in the mid-1930s (Krige 1981: 151). The 1970 census figures indicate that women outnumber men

in the ratio 3:2, a proportion effectively increased by the absence of men working outside the district. Relatively few Lobedu women are employed as migrant labourers but there is a trend for women to work as daily labourers on farms, tea plantations, and in light industry (Krige 1981: 155).

The traditional settlement pattern was one of dispersed villages situated mainly on the highlands and hillslopes. A village was composed primarily of an extended family, the size of which varied considerably with the number of wives, children, and other dependants. The largest settlement was, and still is, the capital, *mosatha* (see Fig. 73A), which in 1975 had a population of over 500 people living in a concentrated clustering of dwelling-units around the central courtyard. Most settlements are much smaller, consisting of between two and ten groups of huts. In the 1930s there were a few larger villages of up to eighty huts (Krige & Krige 1943: 17). New homesteads tend to be very small, sometimes having only two huts, and they are sited wherever land is available. Resettlement schemes, planned for the whole area, have been implemented gradually, causing the division of extended families. Increased mobility is reflected in the tendency for new settlements to be sited near roads leading out of the area (Hattingh 1975: 64).

SOCIAL CONTEXT

Lobedu social structure has been well documented and analysed by Krige (Krige & Krige 1943; E. J. Krige 1964, 1975*a*, 1975*b*, 1975*c*, 1981) and reanalysed by Leach (1961) as well as Kuper (1975, 1982) who suggests that the Lobedu social order can be understood as an extreme variant of the Sotho-Tswana system. While sharing many cultural characteristics with other Bantu-speaking people in southern Africa, the Lobedu have certain distinctive features or emphases that find their closest parallels among neighbouring Lowveld Sotho people and the Venda.

Among the Lobedu it is not unusual for women to hold high public office and, indeed, the last five rulers have been women. Women play significant roles in the social structure both as sisters (in which capacity they are frequently leaders in ritual) and as wives (who are important in the agricultural economy). This importance of women in the social structure is a factor that has encouraged conservatism and adherence to tradition.

Although descent is patrilineal and residence after marriage viri-local, there are no corporate, property-controlling patrilineal groups. In practice matrilateral kin are as important as patrilineal kin. This is best understood with reference to the preferred form of marriage which is between a man and his mother's brother's daughter, his matrilateral cross-cousin. After a number of generations this marriage pattern results in a merging of kin groups and an emphasis on bilateral kinship.

An intricate network of royal marriage alliances has operated through time to extend and consolidate Modjadji's control over a wide area. From throughout her area of influence men sent daughters to Modjadji as a form of tribute or to

solicit aid. These girls were accepted as 'wives', *vhaṯanoni*, and were expected to remain chaste and to serve Modjadji as they would a husband. Those who did not remain chaste were given in marriage to headmen or to royal kinsmen, or they could be 'placed' to rule over a district. The network of affinal links so formed, and implying both rights and obligations, has been an important integrating force within the social and political structure (Krige 1975*b*: 63–64). When Modjadji 'placed' a wife, no bride-wealth was exchanged but it was expected that in time a daughter would be sent to the Queen, so ensuring continuity of the affinal link between ruler and subject.

It has been noted that the role of a sister was central to the Lobedu social system (Krige & Krige 1943: 70). The importance of the sister–brother bond was related to the pattern of marriage. Before money was used as bride-wealth, one of the few ways in which a young man could acquire the cattle to contract a marriage was to use his sister's bride-wealth. As most cattle were tied up in marriage transactions, ideally every brother had a sister whose bride-wealth he could use in order to marry and establish a 'house'. This 'cattle-linked' sister had certain rights in the 'house' which she had helped to establish. In particular she had a claim to a daughter of that 'house' as a wife for her son, i.e. as a daughter-in-law who would cook for her and help her with other domestic tasks, especially in her old age. This would, in fact, be the preferred cross-cousin marriage, and the girl would become the chief wife and bear the heir. Should a 'cattle-linked' sister not have a son, she still had a right to a daughter of the 'house' which she had helped to found. In this case the sister might 'marry' the girl herself, using the bride-wealth of one of her own daughters, and appoint a man to father children in the name of the son that she lacked.

The influence of a sister was often further reinforced by her position as ritual leader in her brother's household. In this capacity she would officiate at all important ceremonies and would be the most appropriate person to intercede with the ancestors on their behalf.

Young wives (with the exception of *vhaṯanoni*) had lower status than sisters. On marriage the rights to a woman's children and to her labour were transferred from her own family to that of her husband. At first a young wife was subordinate to her husband's mother, cooking at her hearth and using her utensils. Later, often after the birth of a child or when a younger wife joined the household, she was given her own *mosha* or 'house'. In a polygynous family each wife and her children formed an independent economic unit.

The subsistence economy was based on agriculture. Three seasons were recognized: *khelemo* the time of hoeing (September–January); *leṯavula*, summer, when the foods were plentiful (February–May) and *maria*, winter, when the fields were bare (June–August). Grain provided the staple diet, supplemented by vegetable produce and veld foods. Neither milk nor meat was a major component in the diet.

Division of labour was not rigidly defined. Both men and women worked in the fields to produce the essential crops of maize, sorghum, and millet. Women

also cultivated fields of ground-nuts, beans, gourds, and other vegetable produce. Children helped with weeding and in protecting the crops from predators. During the dry winter months both men and women worked on renewing the homestead and its material contents. As migrant labour increased women took over many of the tasks formerly done by men thus ensuring some degree of stability in the productive economy.

Religion centred around belief in the ancestors. A creator, *Khuzwane*, was acknowledged but was thought to be remote from everyday life. The ancestors, on the contrary, were thought to be intimately involved with the daily lives and fortunes of their descendants. Their displeasure could cause misfortune, ill-health and, in the extreme, drought. To ensure health, fertility, and prosperity, it was necessary to approach the ancestors by making offerings of beer or grain at their shrines or by invoking them through sacred *thugula* objects, such as heirloom beads or hoe-heads. The presence of ancestor shrines, which often took the form of a small mound of clay in which *thugula* objects were embedded, is an aspect of Lobedu religion also found among other people of the Lowveld and is distinctive to this area (Hammond-Tooke 1981: 153).

Cultural parallels with other Lowveld people are also reflected in the importance of drums, which are sounded on almost all ceremonial occasions, and in the *vyali* and *vuhwera* rituals which are essentially fertility rites, as well as complex initiation ceremonies (Krige & Krige 1943: 126–140). Four sacred drums are believed to be mystically associated with the Queen and the welfare of the people. Formerly they were beaten at the *gômana* initiation to appeal for rain and in thanksgiving for the harvest, practices that have long since fallen into disuse.

Modjadji was in the powerful position of being able to intercede with the royal ancestors on behalf of all her subjects. Her ritual power as a rain-maker was a vital factor in validating the chieftainship. Praised as 'Transformer of Clouds', she was believed able to make or withhold rain, the life-giving force on which fertility was dependent. The whole seasonal cycle was regulated by Modjadji, not only through rain-making but in the tasting of the first fruits and the ritual 'biting' of the first termites.

Rain was symbolic of order in nature. By association with rain, cool or damp places and the materials found there were imbued with positive forces. A river stone buried at the entrance to a village was thought to 'cool' or counteract the forces of evil. Coolness denoted a state of harmony, conversely 'heat' was perceived as a force leading to disorder (Krige & Krige 1954: 68). These two concepts are important in understanding the symbolic content of the material culture and the Lobedu perception of their environment.

TECHNOLOGY

Technology has been simply defined as the complex of learnt behaviour that gives rise to material culture (Spier 1973: 1). It is behaviour concerned with

making things—the materials, tools, skills and processes employed to fulfil material needs. It is also adaptive behaviour, the means by which man interacts with and modifies his environment.

Adaptive strategies, however, do not necessarily correlate directly with available resources. The environment provides a range of resources but cultural responses account for selectivity, for methods of exploitation, and for the value with which certain resources are invested. Ideological as well as economic factors influence the manufacture and use of artefacts.

In the framework for description adopted here, objects are grouped according to the materials of which they are made and three categories of resources are reflected: natural resources indigenous to the environment, domestic resources that are cultivated or the product of animal husbandry, and imported materials. Within this arrangement it is unavoidable that artefacts used concurrently but made of different materials are described separately. Context and related use, however, are indicated and illustrated in the photographs.

USE OF NATURAL RESOURCES

CLAY

Sources of clay are well distributed in the Lobedu area. The weathering of granitized rocks, which predominate in the area, yields clay minerals and quartz. Through selective transport of these materials by water or wind erosion the lighter clay minerals may be concentrated locally, as in the case of clay beds in river-banks. This is the source most frequently utilized by potters. If decomposition of the rocks takes place on site with no transport, the clay will be mixed with quartz particles as the latter are virtually inert and resistant to decay. In this case the clay requires sorting and sifting before use in making pottery.

Muds of rougher texture found generally throughout the area are used for plastering walls and floors of huts, for building courtyard walls and ledges and for making sun-dried bricks (see p. 138). Natural earth pigments such as ochres and chalks occurring in pockets in certain places, are collected, ground into a fine powder and used for colouring walls (Fig. 2), clay utensils and, in certain circumstances, the body. Graphite, which occurs less generally in the area, is also used as a colourant.

Pottery techniques

The manufacture of pottery, described in an earlier paper (Davison & Hosford 1978), is summarized below.

Among the Lobedu, pottery is always made by women, some of whom are specialists and make pots for sale as well as for their own use. Most potters learn how to make pots by watching and following the technique of an experienced potter. The craft is not necessarily passed on from mother to daughter and the present generation of young women show little interest in learning the craft.

In general, pottery manufacture can be separated into at least five stages: digging the clay, preparing it, forming the pot, drying it, and firing. Decorating

Fig. 2. Ochre decorations being applied to wall of courtyard, Modjadji's village, 1973.

Fig. 3. Collecting clay from river-bank, Molototsi valley, 1975.

or burnishing often occurs during the drying stage and may be retouched after firing.

Lobedu potters in the vicinity of the royal village collect clay, *ledzoba*, from two deposits, one about a kilometre from the village, the other about three kilometres away. Both clays, mainly kaolinite, are dug from the banks of dry riverbeds (Fig. 3), but the clay from the further source is darker and finer than the yellowish, coarse clay of the nearer site and needs less preparation for use. The finer clay requires only kneading and the removal of extraneous matter; the coarser clay is dried, crushed, and ground to a fine powder between grinding-stones, covered with water and allowed to stand for a few days before being worked into a homogeneous mass by being pounded with a wooden pestle on a concave stone (Fig. 4A). No tempering material or filler is added to alter the plasticity of the clay.

All Lobedu pots are formed in a similar way. The start is made by placing a rough ring of clay on a movable support (a potsherd, wooden dish, enamel basin or plate) (Fig. 4B). From the ring the lower part of the pot is formed by pinching, scraping and smoothing by hand, adding pieces of clay (Fig. 4C–D) and, when it is roughly the required shape, by smoothing it with the shell of a seed-pod from the *mothema* creeper (*Bauhinia kirkii*). The pod, *thema*, is left in water to become pliable and is then used in a variety of ways, the convex side for smoothing, *-shevola*, the concave side for scraping, and the edge for shaping. At first the *thema* is used to smooth the outer wall in an upward, diagonal movement while the other hand supports the wall on the inside and presses lightly to heighten and shape the sides. Small rolls of clay are added to the sides and worked into the body of the pot. Excess clay from the inner wall is scraped off and any irregularities in the clay are removed by hand or with an awl. To make the rim the upper edge is flattened evenly, using the forefinger and the thumb, and a thin roll of clay is carefully added and smoothed into position. To give a very smooth finish a piece of wet calf-skin, *khekhupulô*, is folded over and moved deftly round the rim. The rim profile is defined by modelling with a *thema*.

The pot is covered with a cloth and taken indoors for a day or two until it is firm enough to be inverted for the filling in of the base. If the pot is to be decorated, designs are incised with an awl before the pot is taken off its support (Fig. 5A). Red ochre, *ledzogu*, powdered and mixed with water, is applied to chosen areas with a finger-tip (Fig. 5B) and burnished with a smooth river stone, *thidêlô*. On the following day when the pot is drier, graphite, *phômô*, is applied in the same way and burnished to a metallic shine. When the pot is firm but still pliable, it is inverted and removed from the support. The thick edges of the open base are pinched inward and excess clay is scraped off; small pieces of clay are added until the opening is completely closed (Fig. 6A). The base is then smoothed with a *thema* (Fig. 6B) and patted into shape with a light wooden beater, *khevhadô*. At this stage unevenness may be corrected and finishing-touches applied to the decoration. Thereafter the pot is set aside in a hut to dry

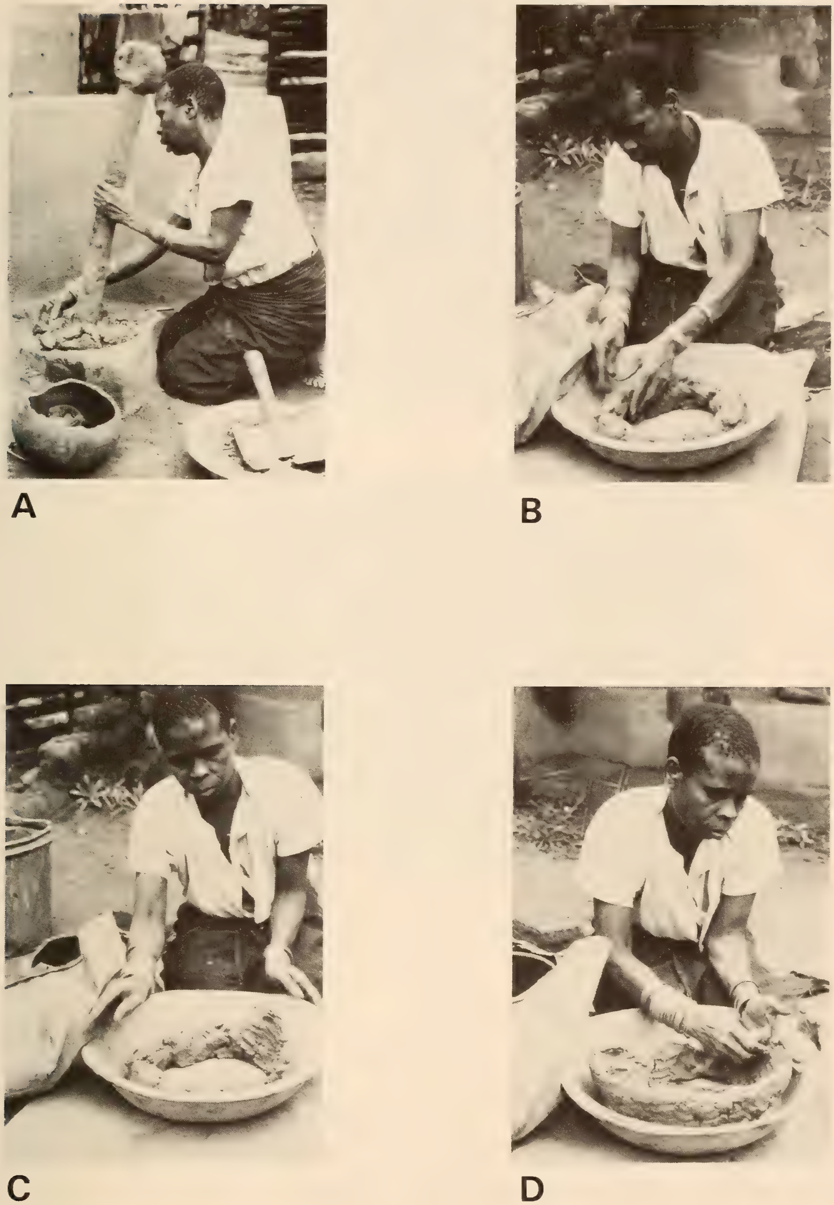


Fig. 4. First stages in making a pot, Modjadji's village, 1975. A. Preparing the clay. B. Positioning a rough ring of clay on the base. C. Starting to build the wall. D. Adding small pieces of clay.

Fig. 5. Decorating a pot for drinking beer, Modjadji's village, 1975.
A. Incising the design. B. Applying ochre to the design.

for at least a week, and often for much longer, until the firing, *-tshuba dibidzha*, takes place.

A number of pots are fired together except in the case of very large pots, which are fired singly. The firing-place is a shallow depression in the ground sited in a place sheltered from the prevailing wind. Towards sunset the pots are positioned and supported on small stones. Slow-burning bark is stacked inside and round the pots; kindling and old thatching-grass is piled on top and ignited. As the grass burns, more is added until the flames are smothered and the burnt grass is insulating the coals within. The fire is left to burn overnight. The following morning, when the pots are cool, they are taken home. The fired ware is usually a reddish terra cotta with some blackened patches due to reducing con-

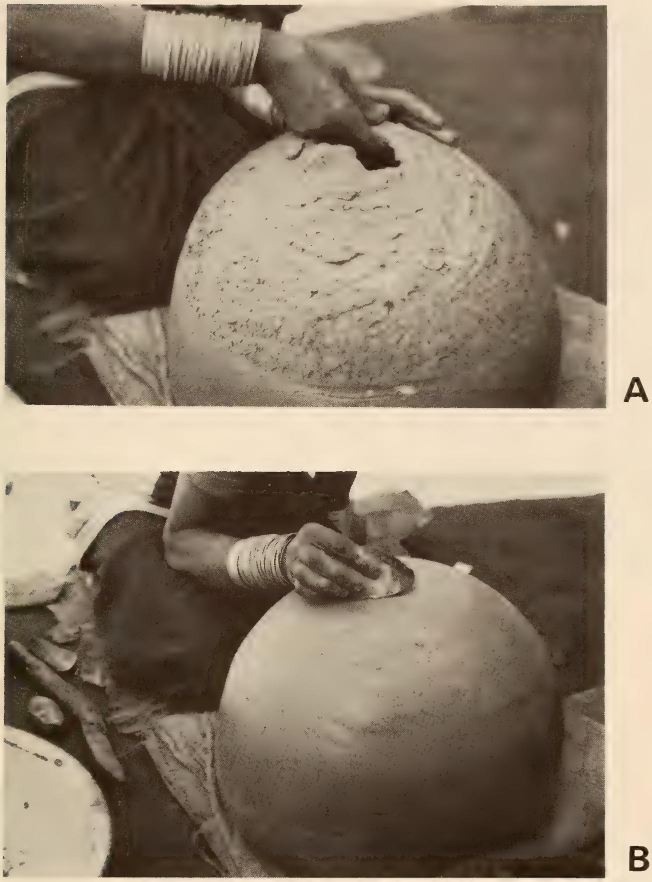


Fig. 6. Completing the base of a pot, Modjadji's village, 1975. A. Filling in the opening. B. Smoothing the closed base with a seed-pod.

ditions in parts of the fire. Burnishing may be retouched after firing (Fig. 7). Breakages in the firing are explained in terms of poor-quality clay or the excessive heat of the fire.

From the available evidence there do not seem to have been any major changes in pottery technology over the past 40 years. The process used today accords with Krige's description for the 1930s (South African Museum correspondence 3.3.66) and the tools are similar to those collected by Krige in the 1930s and recorded by Lawton (1967: 172) in the 1960s. Lawton's (1967: 176) account of a single potter using the method of continuous coiling seems to represent an exceptional case.

Fig. 7. Retouching the burnish after firing, Molototsi valley, 1978.

Types of pottery and uses

Pottery is differentiated primarily according to function which is, in general, related to the shape, size, and decoration of the vessel.

1. *Nkhô* (Fig. 8)

The *nkhô* is a very large, spherical beer-pot, usually decorated on the shoulder and round the mouth. In the 1930s these pots were used on social occasions when many people were drinking beer. If a family did not have its own *nkhô*, one was borrowed from kinsmen or neighbours. By the 1970s in many places the half 44-gallon drum had replaced, or was used concurrently with, the *nkhô* for brewing beer on a large scale. In 1975 the beer-hut of the Molokwane family contained six very large beer-pots partly embedded in the ground, two metal drums in which the beer had been brewed, and two smaller beer-pots from which the beer was served. By 1983 the mud-brick hut had been replaced by a wooden shed but the large beer-pots were still in use.

2. *Modzhêha* (Fig. 9)

This is a large spherical pot usually decorated with bands of cross-hatching on the shoulder and incised geometric designs round the mouth; it is used for carrying and storing water. These pots are still much in use today as water keeps fresh and cool in the porous earthenware. A lighter tin container is widely used to carry water, but there is a *modzhêha* at every home for storing water. The shapes of the pots from the 1930s and 1970s show great similarity, as does the decoration.

Fig. 8. Beer-pot, *nkhô*, Modjadji's village, 1975.

Fig. 9. Water-pot, *modzhêha*, Modjadji's village, 1975.

3. *Thukhwana* (Fig. 10)

A fairly large, spherical or elliptical pot from which beer is served into drinking-vessels. A *thukhwana* is always decorated, traditionally with incised designs coloured with graphite and red ochre but nowadays also with enamel paints. Size, shape, and design vary greatly. These and pots for drinking beer, which are the most ornately decorated pots, are used for entertaining. In the 1930s an elliptical-shaped pot, *thukhwana ya lebile* (SAM–9793), said to have been inspired by the tread and shape of a motor-car tyre, was adopted from Kgale potters on the highveld and became very popular among the Lobedu (E. Krige 1977 pers. comm.). Highveld Sotho influence is also seen in the arc design and the use of stamped lines on some of these pots (e.g. SAM–9797, UCT 38/83).

Fig. 10. Pots in washing-area. Beer-pot, *thukhwana*, left; water-pot, centre; cooking-pot, right. Modjadji's village, 1975.

4. *Ledzhômêla* (Fig. 11A–C)

This small decorated drinking-vessel is used when offering beer individually to an honoured guest. The smallest ones are also used to store baby food. Their shapes vary but they are always decorated with incised, coloured designs. Many modern examples are flat-based.

The *ledzhômêla* was introduced by Tsonga immigrants, as was the term used to describe it (Lawton 1967: 177), and it has largely replaced the traditional calabash beer-vessel, *phafha*.

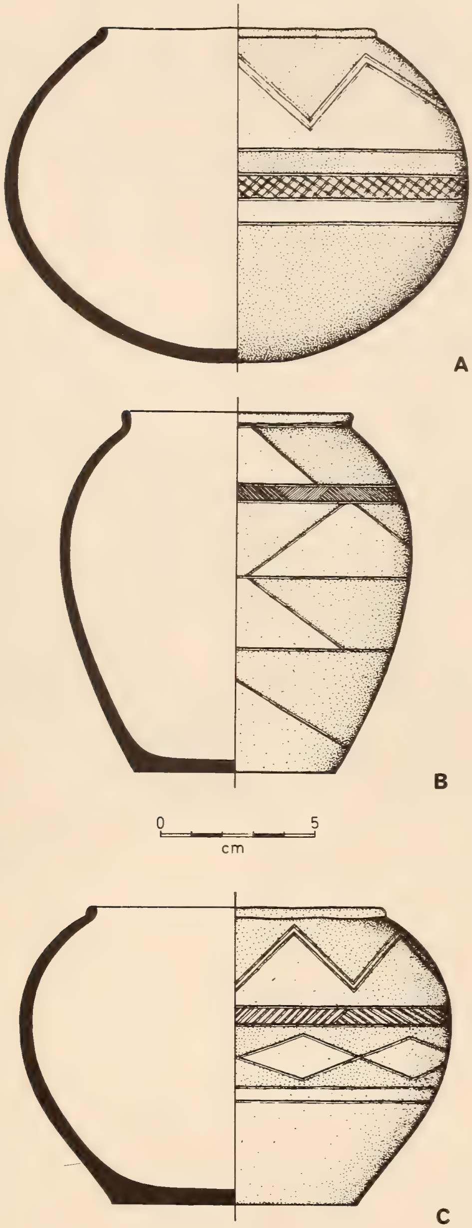


Fig. 11. Drinking-vessels, *madzhômêla*.
A. SAM–9800, Krige Collection, 1936–8. Traditional pot for drinking beer. B. SAM–9801, Krige Collection, 1936–8. Flat-based pot inspired by the shape of a jam jar. C. SAM–10603, collected 1976. Pot of traditional shape and decoration but with a flat base.

5. *Bidzha ya khelalêlô* (Fig. 12)

This spherical cooking-pot is made in various sizes. The large ones are used mainly for cooking porridge and the smaller ones for preparing vegetable relish or meat. Decoration on these pots is minimal, usually a single line or a band of cross-hatching on the shoulder and graphite colouring round the rim. They blacken rapidly on the hearth and become seasoned and non-porous through use. The simplicity of decoration and lack of red ochre distinguishes cooking-pots from pots of similar shape not used for cooking.

Fig. 12. Cooking-pots waiting to be washed before use, Modjadji's village, 1975.

6. *Morifhi* (Fig. 13A)

This is an open bowl used for cooking certain relishes such as termites and locusts that do not need to be covered. It is also used as a lid for a cooking-pot and has many other household uses. A *morifhi* is seldom decorated with incised designs. Occasionally graphite is applied to the rim as a finishing-touch.

7. *Kheritswana* (Fig. 13C)

This fairly small open bowl is used for drinking marula-cider, *mokhobe*, and for serving relish. A *kheritswana* used for marula-cider is always burnished with graphite both inside and out. This distinguishes it from a *morifhi* of similar

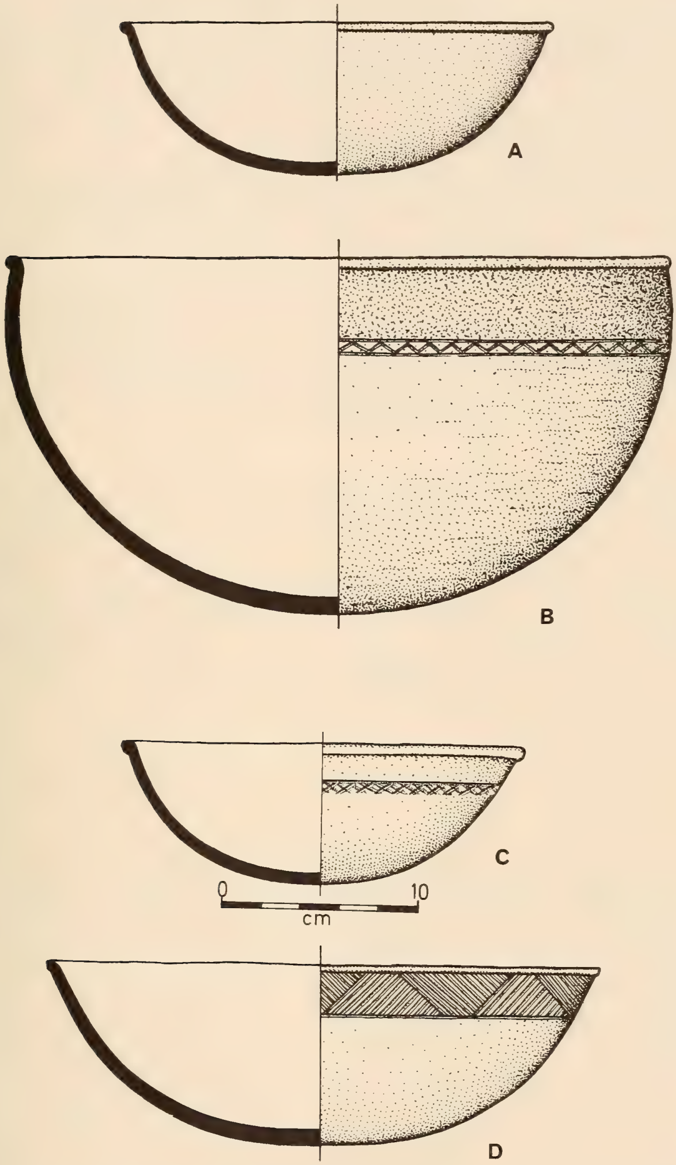


Fig. 13. Bowls. A. *Morifhi*, SAM–9706. B. *Lebêḓa*, SAM–9787. C. *Kheritswana*, SAM–9788. D. *Lesabêlô*, SAM–9804. (All Krige Collection, 1936–8.)

shape. It is often, but not always, decorated with an incised band of hatching or cross-hatching near the rim. Modern examples are sometimes made with flat bases.

8. *Lebê̱da* (Fig. 13B)

This large open-mouthed pot, roughly half-spherical in shape, was traditionally used for steeping maize prior to stamping and during the beer-making process. When woven beer-strainers were used, beer was always strained into a *lebê̱da* (Krige & Krige 1943: pl. 11b) but this is no longer done, as beer is now brewed on a much larger scale in metal drums. The *lebê̱da* is still made and used for soaking grain, particularly during and just after the reaping season but its use has declined since the 1930s as many people no longer produce their own grain. A *lebê̱da* is usually undecorated except for an incised band below the mouth.

9. *Lesabêlô* (Fig. 13D)

This open bowl used as a wash-basin is always decorated with a broad, incised band of hatching round the rim. White chalk is rubbed into the incisions and the bowl is burnished with graphite inside and outside. It was customary for a wife to bring her husband a *lesabêlô* of warm water for washing in the morning. In the 1930s Krige recorded that these bowls were rare and had been replaced almost entirely by enamel basins. In the 1970s the traditional bowl was said to be used for ritual purposes especially by *malôbô* dancers.

10. *Khetsikhiyô* (Fig. 14)

A deep bowl with a heavy, flat base and striated inner walls is used for grinding tobacco, *-sila lefôla*, into snuff (see Fig. 54). Occasionally there is an incised band near the rim but most examples are undecorated.

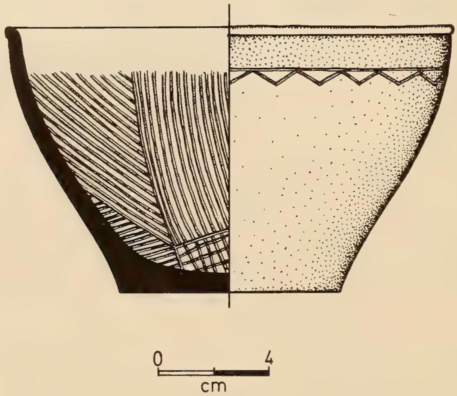


Fig. 14. Pot for grinding snuff, *khetsikhiyô*, SAM–9802, Krige Collection, 1936–8.

Snuff-making is still widely practised and involves drying tobacco leaves and grinding them to a powder in the *khetsikhiyô* with a wooden pestle, *kherêgêlê*. The ground tobacco is passed through a wire gauze sieve or winnowed to remove the chaff and is then reground to a fine powder. This is blended with the ground ash of a special plant, *mokhagô* (*Amarantus spinosus*) to give the snuff the desired pungency. The mixture is dampened with water to ensure a good blend and the pot is placed on the hearth to dry the snuff.

11. *Roughly made and broken pots*

The Queen's rain medicines are kept in rough earthenware pots, *mehago* (Krige & Krige 1943: 273).

Roughly made pots, sometimes unfired, are used for storing seeds, dried tobacco or ground-nuts. These pots may represent the efforts of a novice still learning to make pots or a poorly made pot that the maker does not want to discard.

Pots cracked near the rim are often repaired with beeswax or resin (Fig. 15). Fine wire or fibre may be bound round the rim to hold the join in position.

Potsherds are used in a number of ways. The bowls of large broken pots are used as basins for washing a baby (Krige & Krige 1943, pl. 5b) or when cleaning utensils before use. Smaller sherds are useful as containers for mixing ochre, graphite, or herbs. New pots are built up on flat potsherds. Certain medicines, especially those burnt to give ashes, are kept on sherds. Small pieces of broken pottery are embedded in the floor of the courtyard to act as door-mats and to prevent erosion in drainage areas. Sherds were also embedded in the bases of threshing-pits in the fields.

Fig. 15. Pot repaired with resin, Modjadji's village, 1975.

12. *Pots used in termite traps*

In the early summer months traps, involving the use of small pots, are made to catch *dinn̯twa* termites (a very important food source). A hole, *mokhobô*, is dug in a termite heap, *kheulu*, and a pot placed inside. A framework of sticks, *madzwari*, is placed over the hole and covered with leafy twigs. A small opening is left to allow light in near the pot. When the termites swarm they fly toward the light and get trapped in the pot.

Other uses of clay

Toys

Clay is used by children to model toys. Herd-boys make clay oxen to resemble the long-horned cattle they admire. Small girls make miniature clay imitations of their mothers' utensils and use them in play-housekeeping which is an informal training in home-making.

Tuyeres

When iron-working was an active industry, clay was used to form the nozzles for the bellows and for constructing the walls of the furnace.

Whorl

A ceramic whorl was used to weight the spindle used in spinning wild cotton (see p. 91).

GRASSES AND OTHER PLANT FIBRES

Formerly the indigenous vegetation provided a very rich source of grasses, sedges, creepers, barks, and other plant fibres. By the 1980s much of the natural vegetation had been cleared for cultivation with the result that the plant resources had been reduced and greater distances had to be travelled to find particular plants. Krige & Krige (1943: 47) commented on the impressive body of botanical knowledge that the Lobedu put into practice in their craftwork. Craftsmen had specialized, practical knowledge of the many different plant fibres suitable for making string, baskets, and mats. The quality of the material was carefully selected for the object in mind. Pliability was necessary for strainers, strength for baskets, and resilience for sleeping-mats. The long-established usefulness of certain plants is reflected in the vernacular terminology. The species of acacia most frequently used for weaving winnowing-baskets is known as *moloha*, from *-loha* meaning to weave. Many objects have the same name as the material used to make them, for example the sleeping-mat, *pat̯e*, made from the sedge of the same name. Symbolic associations also influenced the choice of materials especially in the case of initiation costumes.

Seasonal availability of grasses and sedges restricts their use to certain times of year. Thatching-grasses may not be cut before Modjadji has given her consent. This restriction reflects the chief's control over an essential resource but it

is also a practical measure ensuring that the grass is not cut until ripe (Krige & Krige 1943: 47). Ease of collection influences the choice of material. If the appropriate material is inaccessible because of drought or distance from the source, a suitable substitute may be used. Substitute materials, however, do not usually have the particular qualities of the original material and this is evident in the product. The accessibility of cultivated sisal as well as the strength of the sisal fibre has made it an acceptable substitute for many of the indigenous fibres formerly used for the making of rope and string.

Basketry techniques

The two main technical categories of basketry, *coiled or sewn* and *woven*, and the variations found in Lobedu basketry are defined briefly below.

In *coiled* and *sewn* basketry a coiled foundation is sewn together with one of a variety of stitches. A needle may be used but is not necessary if the sewing-fibre is fairly rigid and is used in conjunction with an awl. In simple *oversewing* each stitch passes over the foundation coil and pierces the row below. If the stitch splits the stitch in the previous row a forked effect is produced, this is known as *furcate* sewing. Another variation, called *bee-skep*, has widely spaced stitching connecting the coils at intervals, so that each stitch is just above the one below. The foundation material is variable and may consist of a single rod known as a *simple foundation* or a cluster of strands known as a *multiple foundation*. If the material of the coil is too stiff to allow a stitch to pass through it, the coil is joined by passing a strand through the fabric of the basket to link adjacent rows of the coil. A sewn technique is used for certain mats and beer-strainers in which case the work is flat or cylindrical and the sewing-strand passes through the other element.

In *woven* basketwork two elements, the warp and weft, cross over and under each other. The manner of crossing or weaving creates different patterns. A twill, which is widely used for making winnowing-baskets, is characterized by the weft passing over and under two or more warps with each successive row starting one warp ahead of the previous row. Other woven techniques used by the Lobedu include *wicker-work* in which the warps are rigid and the wefts flexible (as in a reed-door), and *twining* in which two wefts pass alternately in front of and behind each warp (as in sleeping-mats).

In practice both woven and sewn techniques may be used in a single basket, for example the rim of a woven winnowing-basket is oversewn. When used without qualification, the terms apply to the main fabric of the basket.

Uses of basketry

Baskets

1. Coiled, sewn baskets

The *moṭhaṭha* or *kherodo* (Fig. 16A) is a large basket for carrying produce from the fields and for general household use. A coiled technique is used in its

Fig. 16. Sewn baskets. A. *Moṱhaṱha*, SAM–9738. B. *Kheṱhaṱhana*, SAM–9741. (Both Krige Collection, 1936–8.)

manufacture, and the material most often used for both the coil and the sewing-strand is the stem of the creeper *lebibye* (*Cocculus hirsutus*). To prepare it for use, the creeper is boiled in water until the outer bark is loose and can be pulled off easily. While still damp and flexible from soaking in warm water, the stem is cut through the middle and stripped of the inner pith (Fig. 17). The stems can then be scraped down to the required thickness for use. For the foundation it may be left whole or split in half; the wrapping-fibre is pared down into thinner strands. *Lebibye* may be prepared well in advance and stored until required.

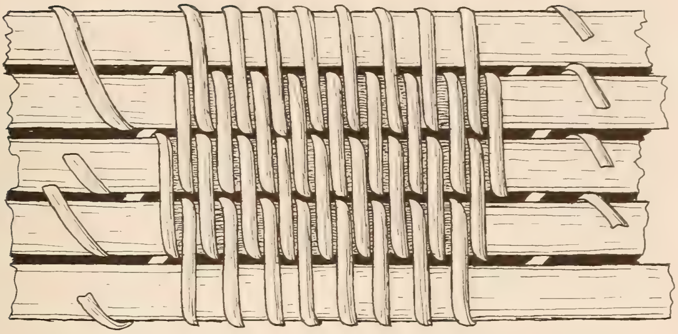
The *moṱhaṱha* and similar smaller *kheṱhaṱhana* baskets (Fig. 16B) are made

Fig. 17. Women preparing strips of *lebibye*. Note pot of water for softening the fibre and the use of the toes for holding the fibre. Photo: E. J. Krige, 1936–8.

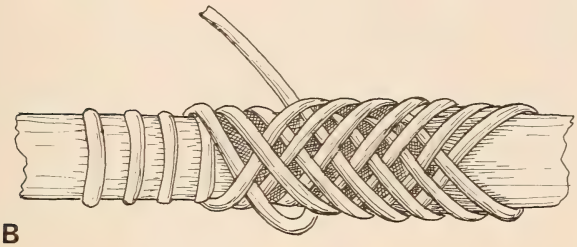
by women (Fig. 18). The foundation is joined by passing the thinned creeper over two coils to interlock with the previous row (Fig. 19A). An awl, *morogola* (see Fig. 110B), is used to make a space for the creeper to pass through. Dry *lebibye* is inflexible and must be dampened with warm water before use, as is generally the case in much basket-work. The rim of the basket is thickened with any pliable stick and oversewn in a herring-bone pattern (Fig. 19B–C). A piece of hide may be sewn onto the base to protect it from wear. The final product is a very strong durable basket.

Fig. 18. Woman working on a *mot̂hat̂ha*. She is using an awl to make a hole for the sewing-strand to pass through. Photo: E. J. Krige, 1936–8.

The smaller domestic basket, *khet̂hat̂hana*, is generally made in the same way but not always of the same materials. Bark fibre may be used for the sewing-strand but this is not as durable as *lebibye* as it frays when cleaned in the customary way of scouring with sandstone. If grass is used for the foundation, as in one example (Fig. 16B), the coil is many stranded and is sewn together, in this case with bark fibre, using a furcate (Fig. 20) stitch. This basket lacks the firmness and strength of those made with *lebibye*.



A



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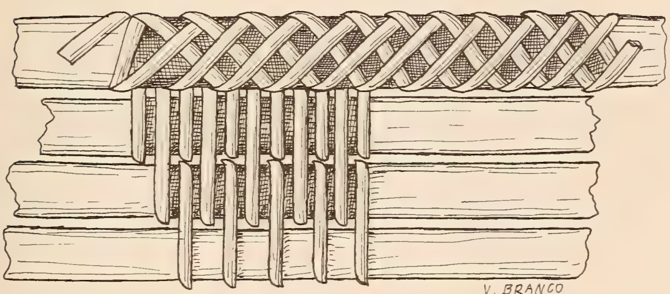


C

Fig. 19. A. Interlock oversewing-technique. B. Herring-bone rim-binding. C. Rim attachment to basket.

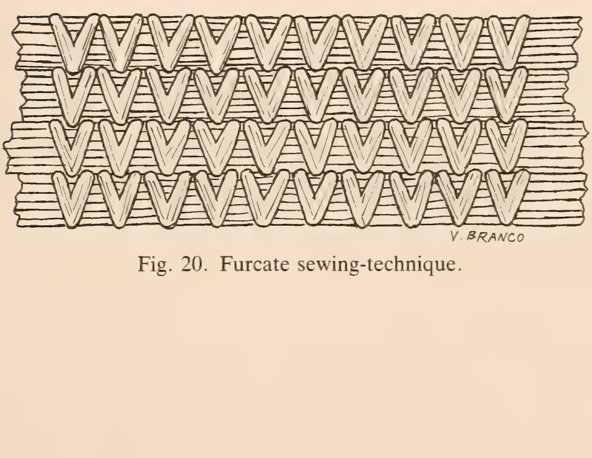


Fig. 20. Furcate sewing-technique.

Formerly, when there was a surplus of grain to be stored, men made large, coiled grain baskets with lids that could be sealed with dung. A *kheséhô* was made with a foundation of *lefhe* grass sewn together with bark fibre using a bee-skep stitch (Fig. 21). The rim of the mouth was oversewn with bark fibre in herring-bone stitch.

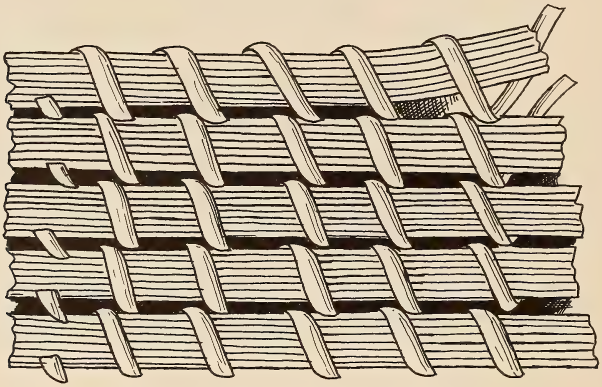


Fig. 21. Beeskep sewing-technique.

2. *Woven baskets*

The woven winnowing-fan, *lesêlô* (Fig. 22A), the smaller but similarly formed basket, *tsana*, and the serving-basket, *kherodwana* (Fig. 22B) were made, and in the case of the *lesêlô* and *tsana* still are made, by men from thin strips of wood cut from a branch of a suitable tree, most commonly *moloha (Acacia ataxacantha)*. Their manufacture is described here and not in a later section on the use of wood as, apart from the cutting of the wood, basketry techniques are employed.

In addition to the wood slivers used for both warp and weft elements, lengths of firm but flexible wood and creeper stem are required for the rim. The materials are collected and prepared in advance. The strips of wood are pared with a knife to similar lengths and thickness; the wood for the rim is cut to the length that will allow it to be bent into a hoop, *legôkô*, the size of the circumference of the rim, and the overlapping ends are secured with a small dowel. The creeper *lebibye* is prepared as described above for the coiled baskets.

The craftsman first dampens the wood slivers in warm water, takes four strips to start and incorporates additional strips by weaving in a straight twill over two (Fig. 23A) until a square is complete. While weaving the craftsman supports the work on his lap or on a piece of wood on the ground. The hoop is tied to the flat woven square in four places, the corners of the square are cut off and the remaining circular piece is then pushed through so that the hoop is on the outside. A thin plant stem, *khuzwane*, is tied on the inside of the rim, which

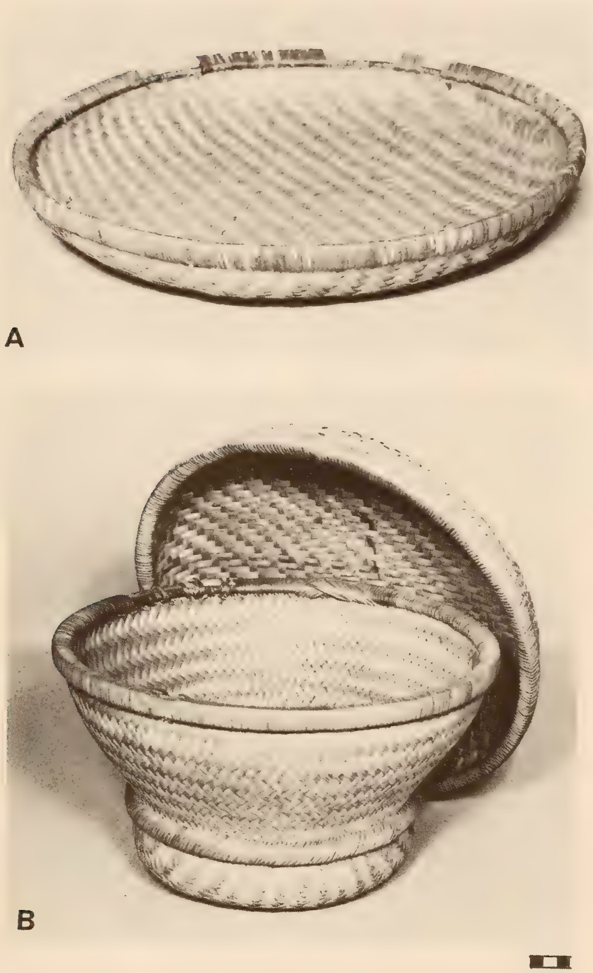


Fig. 22. Woven baskets. A. Winnowing-basket, *lesêlô*, SAM–9679. B. Serving-basket, *kherodwana*, SAM–9673. (Both Krige Collection, 1936–8.)

is then oversewn with the creeper binding (Fig. 23B–C). An awl, *morogola*, is used to make holes through which the creeper is threaded (Fig. 24A). The ends are worked into the binding and the finished product is very strong and neat.

Winnowing-baskets collected in the 1970s do not differ from those collected by Krige in the 1930s and they are used whenever it is necessary to separate coarse from finer matter. Winnowing, *-fhefhêra*, is essentially an up-and-down fanning movement during which lighter matter is separated from heavier. It is a

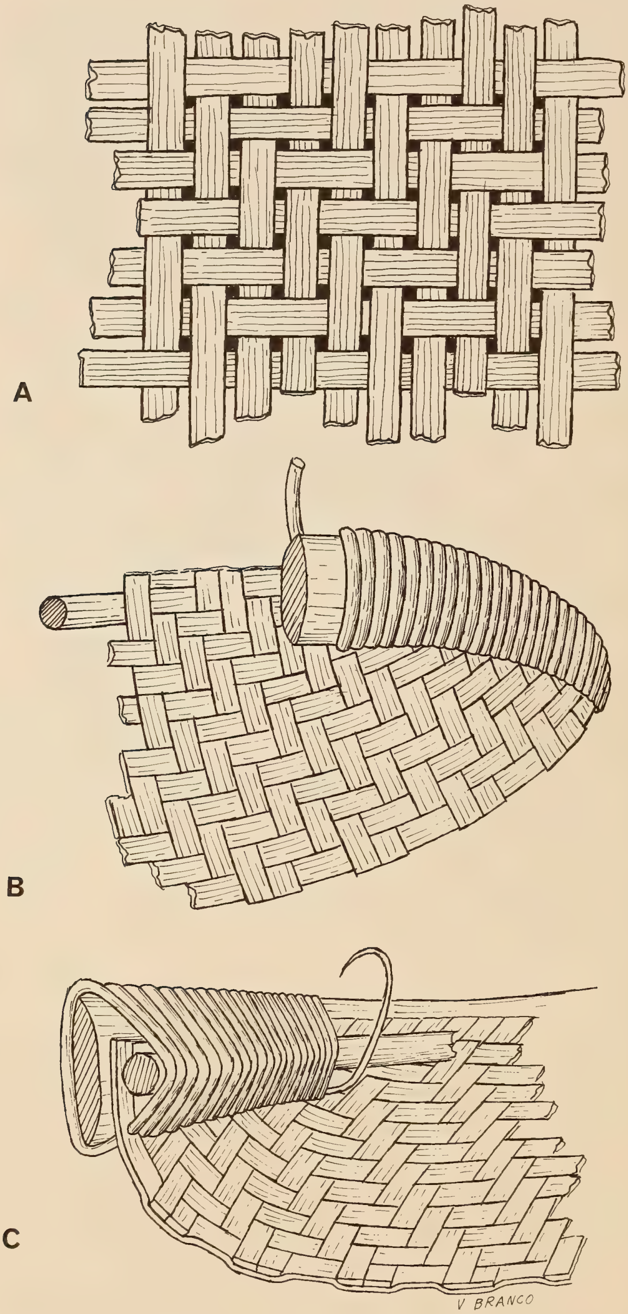
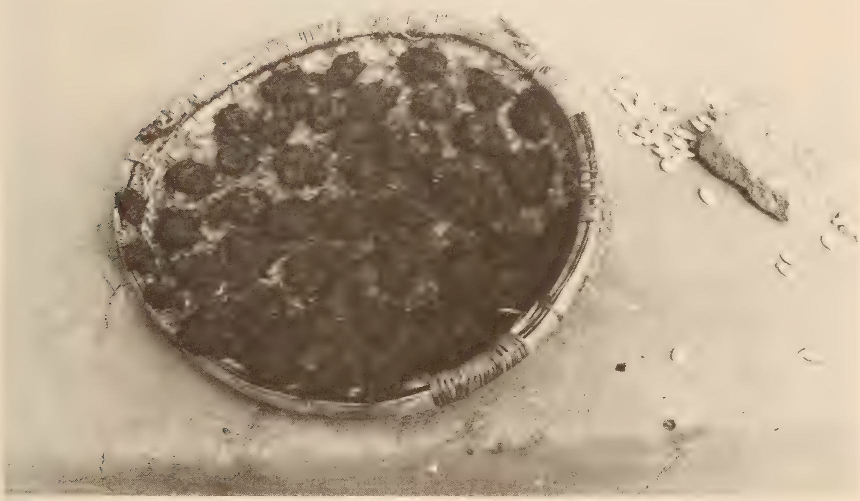


Fig. 23. Weaving-technique for winnowing-baskets. A. Slivers of wood woven in a twilled pattern. B. Rim-binding, outside. C. Rim-binding, inside.

A



B

Fig. 24. A. Basket-worker binding the rim of a *lesêlô*. Note use of awl. Mohale's village, 1973.
B. Relish drying on an old *lesêlô*, Modjadji's village, 1975.

process much used by Lobedu women both in the fields to free the chaff from the heavier grain (Figs 25–27) and at home when stamping maize into meal or when they wish to separate dry ingredients.

When maize is stamped by hand the *lesêlô* is a necessary complement to the pestle and mortar in the successive stages of the process that produces meal of different texture and so adds variety to the staple porridge diet. After the first stamping, *-thovola*, the grain is winnowed in an up-down action, *-fhefhêra*, to separate the outer husks, which are made to fall to the ground. Thereafter the basket is moved in a rotating action, *-sêlêla*, so that the larger husks come to the

Fig. 25. Woman winnowing sorghum with an up-down movement, *-fhefhêra*, to separate the grain from the husks. Photo: E. J. Krige, 1936–8.

Fig. 26. Woman holding the winnowing-fan to the wind to separate the heavier grain from the chaff. Photo: E. J. Krige, 1936–8.

top in the centre. These are removed by hand and kept as food for the pigs; the de-husked grain is returned to the stamping-block and the process is repeated at least twice. The husks of the next winnowing are kept for making *mabudu*, a light beer; those of the following are used for making *maase*, a fairly granular porridge. At this stage the stamped grain, *thovole*, is placed in a pot, covered with water and left for a number of hours before being drained on a *lesêlô*. The water in which it was steeped is kept for making soft porridge, *vhothithi*, which has a slightly sour flavour. The grain is then ready for the second stamping-process, *-seḓa*, which results in the fine, white flour used for making the staple porridge, *vhoswa*.

Fig. 27. Woman separating the coarser grain in the centre of the basket, after winnowing with a rotating action. Photo: E. J. Krige, 1936–8.

Apart from its use in winnowing, the *lesêlô* can be used as a tray for serving guests at beer-drinks and for many other general household purposes, including the drying of relish (Fig. 24B) for use in the dry winter months when fresh greens are scarce. The smaller *tsana* has many domestic uses and is especially useful for holding maize-meal or relish during the preparation of food, and as a lid for other utensils.

The *kherodwana* is a waisted basket with a lid, that was used traditionally for keeping food warm, for serving an honoured person, and also for carrying goods. The lid, made in the same way as a *tsana*, could be used on its own as a small basket. The shape of the basket was designed to fit a wooden dish, *delô*, on which porridge was served and set aside in the basket to keep warm until eaten. The base of the *kherodwana* was made in the same way as a *lesêlô* and similar materials, strips of *moloha* wood and *ditsidwa* or *lebibye* creeper, were used. For the sides of the baskets the ends of a rectangular mat of twilled wood slivers were woven together to form a cylindrical shape that narrowed at the lower edge to fit into the rim of the base. The join was oversewn with creeper binding. The upper edge of the basket was fitted with a ring of wood as for the rim of a *lesêlô* and was oversewn. The making of this basket required more technical skill than other baskets and it had particular social importance.

A

B

Fig. 28. A. Woman making a twined sleeping-mat. Photo: E. J. Krige, 1936–8. B. Woman making a twined sleeping-mat. Ramalepe's village, 1973.

In the 1930s every Lobedu bride took a *kherodwana* to her new home as a symbol of honour to her husband. It was customary for the bridegroom's father to instruct the bride, through his wife, to serve food to the groom in this 'marriage' basket (Krige notes). By the 1970s changing social conditions had made the *kherodwana* obsolete. This followed changes in the pattern of marriage related to an increase in migrancy. As it became common for young men to be away for long periods of migrant labour, many marriages were contracted in the absence of the bridegroom. In these circumstances there was no need for the customary use of the *kherodwana* in marriage ceremonial or in the domestic sphere.

Mats

Two types of mat were used: *paṱe*, a twined sleeping-mat, and *khegôyô*, a sewn mat for drying meal or for sitting on. Both mats were formerly made only by men (Krige notes) but as migrancy reduced the number of men in the villages women took over the task of making sleeping-mats. In the 1930s both men and women wove mats (Figs 28A, 29), in the 1970s they were made almost exclusively by women (Fig. 28B).

Fig. 29. Man making a twined sleeping-mat. Note use of pegs and pot of water for softening the fibres. Photo: E. J. Krige, 1936–8.

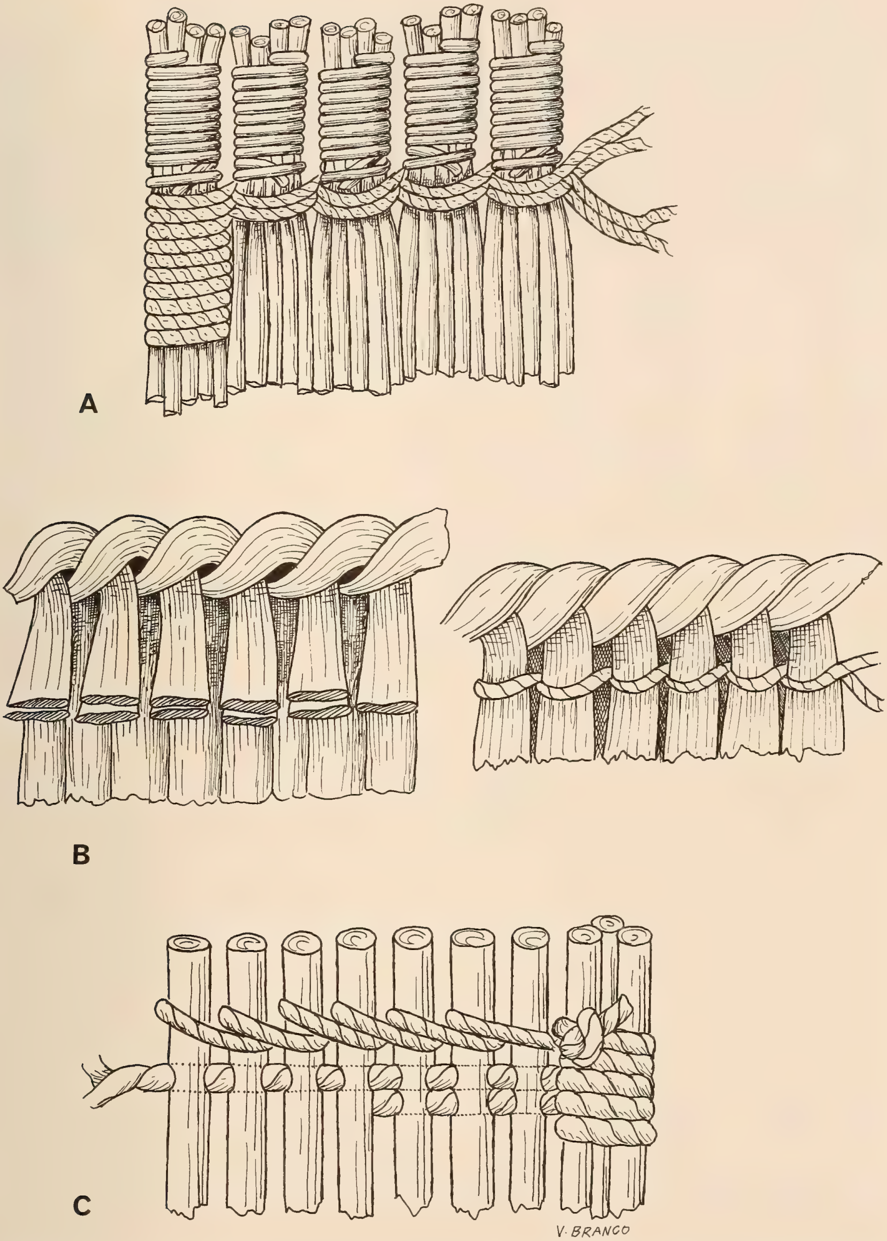


Fig. 30. Techniques of finishing edges of mats. A. Whipped edge of sleeping-mat. B. Knotted edge of twined sleeping-mat. C. Wrapped edge of sewn grain mat.

Sleeping-mats are made from a sedge, *paṱe* (a species of Cyperaceae). Four or five lengths of sedge are tied together to form multiple warps, and work proceeds from the one side or the centre by twining the warps together with string, the ends of which may be secured with pegs (Fig. 29). The string is usually made from sisal, *mokhôda*, but formerly *moleṱe* (*Triumfetta pilosa*) bark was used. Rows of twining are evenly spaced across the width of the mat. The ends of the sedge are normally trimmed and finished off with a simple knot (Fig. 30B). The ends of the string are wound round the last warp a few times and knotted. Warp ends may be whipped with single-ply twisted sedge (Fig. 30A). The completed product is a thick and comfortable mat on which to sleep.

Making sleeping-mats on a vertical wooden frame (Fig. 31) is a recent practice which seems to have been introduced by Tsonga-speakers. Grooves are made at regular spaces along the horizontal beam of the frame to mark the position of the strings that are tied to the first length of sedge. Work proceeds by adding bundles of sedge that are twined together with the strings until a mat of the required length is made. During the work the strings are weighted with stones to keep the mat in position and the tension even. This is a much quicker way of making mats than the traditional method.

The *khegôyô* mat for drying meal after stamping is no longer in regular use as most people now buy their maize-meal. It was made from lengths of thin sedge, *khegôyô* (*Cyperus textilis*), sewn together by a strand of twisted *moleṱe* bark fibre passed through the sedge with a metal needle, *lemao*, in a series of rows. The edges were trimmed and wrapped with string (Fig. 30C). According to Krige (notes) this type of mat was adopted from Tsonga immigrants.

Fig. 31. New method of making a sleeping-mat on a wooden frame. The twining-threads are weighted with stones. Molototsi valley, 1973.

Wicker doors

A door, *khezwala vhatimana*, made by men using a wicker basketry technique, was the traditional door for a cooking-hut. Translated literally, the vernacular term means 'something by which selfish people keep each other out', i.e. to obviate the need for hospitality.

These doors were constructed by making a lattice of thick *mbaseriti* reeds and any suitable thinner poles or sticks held together by wrapping (Fig. 32) with a strong bark fibre such as *motswiriri* (*Bauhinia galpinii*).

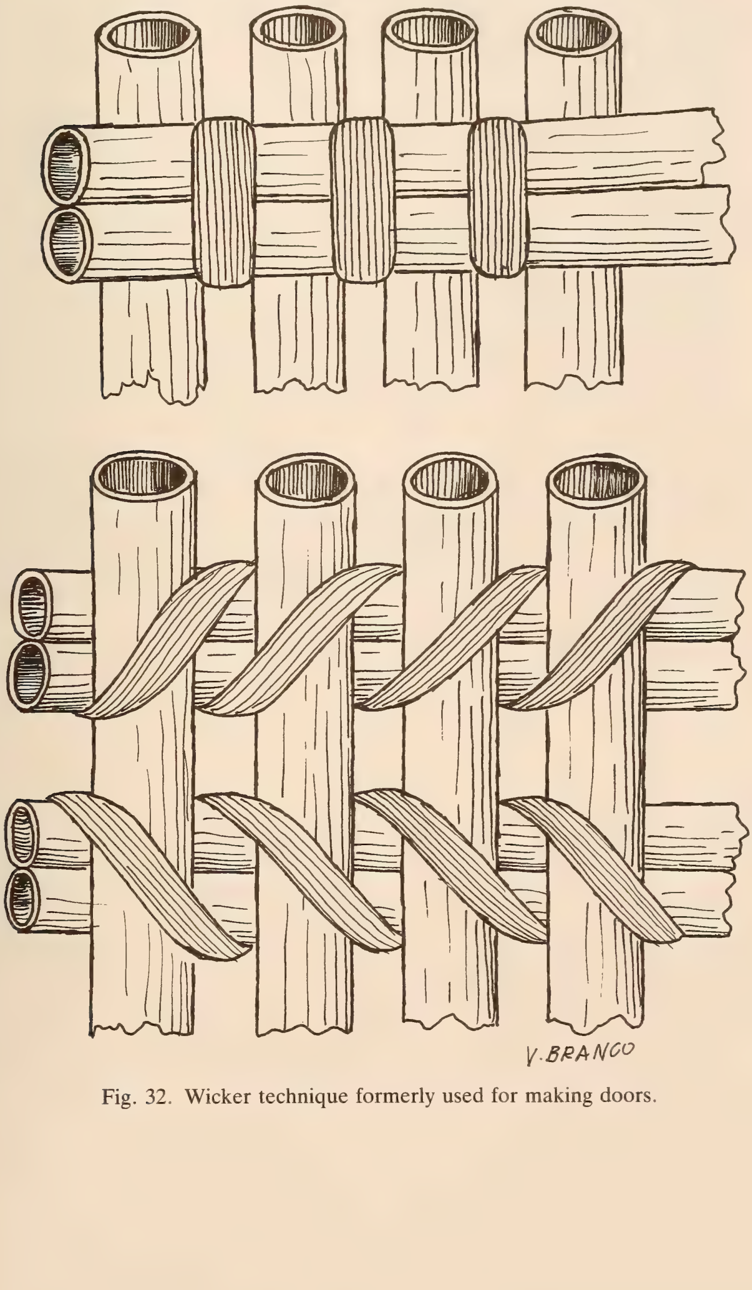


Fig. 32. Wicker technique formerly used for making doors.

Reed doors were not hinged. To close one from the inside a pole was passed through a thong loop attached to the centre of the door, and across the door frame; from outside it was held up with a heavy object such as a wooden pestle. These doors were smeared with cow-dung both to prevent draughts and to protect them from infestation by weevils. When not in use as a door it could be used as a large rigid mat on which to place things. Krige records that they were rare in the 1930s; they were not seen at all in the 1970s.

Strainers

The traditional Lobedu beer-strainer *leṯhôḓô* (Fig. 33A) was woven by men (Fig. 34) from a number of different plant fibres, for example 'bobbejaanstert',

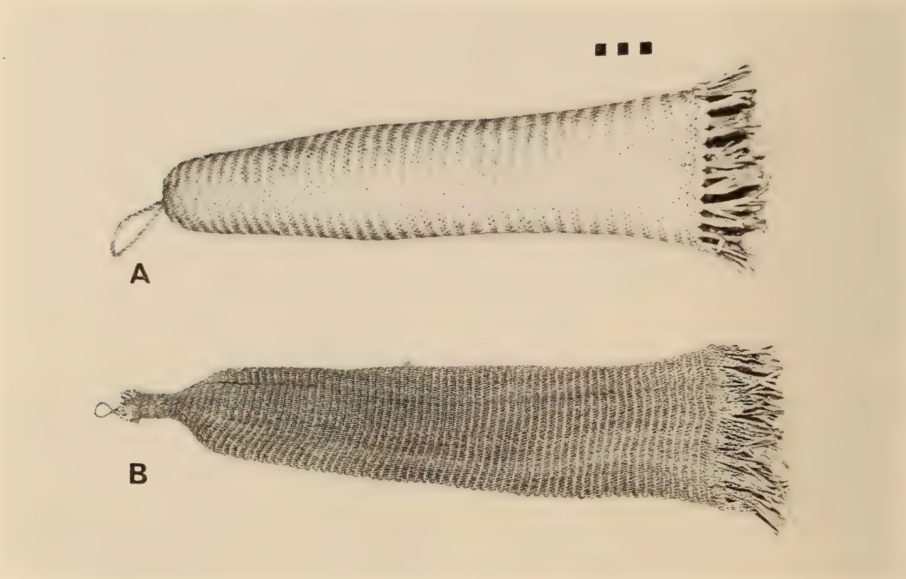


Fig. 33. Beer-strainers. A. Woven, SAM–9750. B. Sewn, SAM–9749. (Both Krige Collection, 1936–8.)

kheruje (Vellozia retineris), *tsenyane* grass (*Ophioglossum* sp.), or strips of wood from the *moleṯe* or *moloha-ṯhôḓô* tree (*Triumfetta* sp.). The same material was used for both warps and wefts, which were woven together in a twill pattern. The start was made by knotting a row of strands together (Fig. 35A) and weaving continued in a tubular manner. To close the base the strands were gathered tightly, the ends knotted and turned inside the strainer.

A sewn strainer *leṯhôḓô la horokiwe* (Fig. 33B), said in the 1930s to have been recently adopted from Tsonga-speakers (Krige notes), was made from the midrib of the leaf of *modolo* (*Ensete ventricosum*) twisted into two-ply string. The start was made at the open end and the sewing-strand was passed through

Fig. 34. Man weaving a strainer while attending a court case in the *khôrô*. Photo: E. J. Krige, 1936–8.

knots in the string (Fig. 35B) to form a circle. A needle was used for the sewing and work continued in a spiral with the sewing-strand passing through the string (Fig. 35C). At the base the strands were sewn into a tight bunch.

Both woven and sewn strainers were used in the same manner. Unstrained beer was poured through the *leṱhôḓô*, which was wrung in the hands with a twisting action so that the liquid passed through the fibres and the dregs remained behind. The receptacle for the strained beer was a wide-mouthed pot, *lebêḓa* (see p. 66). By the 1970s both types of basketry strainer had been replaced by a large wooden sieve, *sefô* (see p. 113). This replacement related to an increase in the scale of brewing beer for sale.

A

B

C

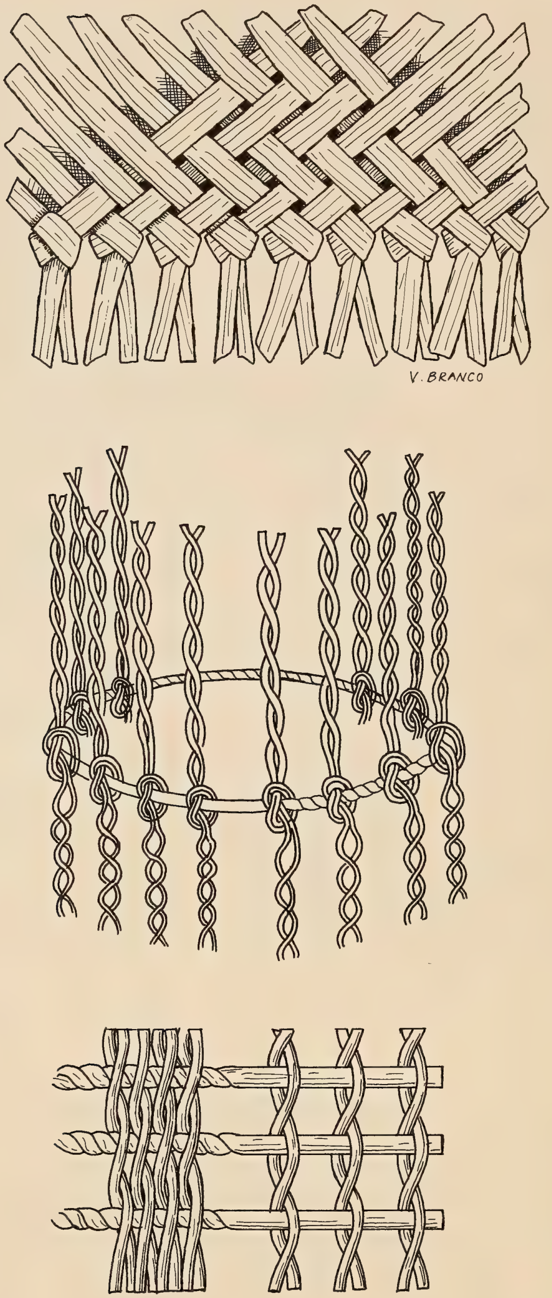


Fig. 35. Beer-strainer techniques. A. Diagonal twill weave, knotted start. B. Start of a sewn strainer. C. Sewing-strand passing through two-ply foundation.

Playthings

In summer when the grasses are long, boys and girls make a variety of playthings and ornaments, using basketry techniques. Examples in the Krige Collection include armbands, a grass peaked cap, *kêpisi ya bosigijane*, made in imitation of a schoolboy's cap, and a hat, *gadiba*, also made of *bosigijane* grass (*Sporobolus pyramidalis*). The hats have coiled foundations of bundles of grass sewn together with single strands of grass. Plaited and woven techniques (Fig. 36) are used for making armbands that imitate the ornaments worn by

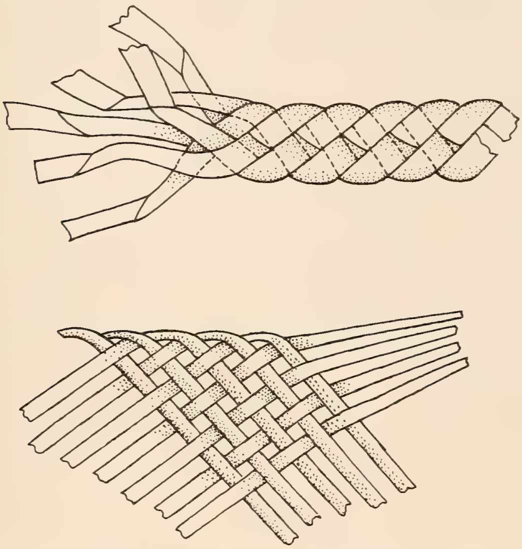


Fig. 36. Plaiting- and weaving-techniques used for making armbands.

adult women and are referred to by the same names, *masêga* and *khefhôdô*. Single lengths of grass are made into toy arrows to be used with a small bow made of a pliant stick and bark.

Other uses of grass and plant fibres

Brooms

The simplest broom, *lefiêlô* (Fig. 37A), is easily made from a bundle of *lefiêlô* grass (*Aristida congesta*) pulled out by the roots and tied at the grip with string. Rough brooms for sweeping outside and for cleaning the hearth are made in the same way from *motataile* (*Arthrixia phylicoides*) or *lefaladza maru* (*Asparagus phimosus*). When *bosigijane* grass is used the broom is made in a different way (Fig. 37B) as this grass does not pull out easily by the roots. Lengths of grass are twined together, folded over, rolled up, and bound at the grip with

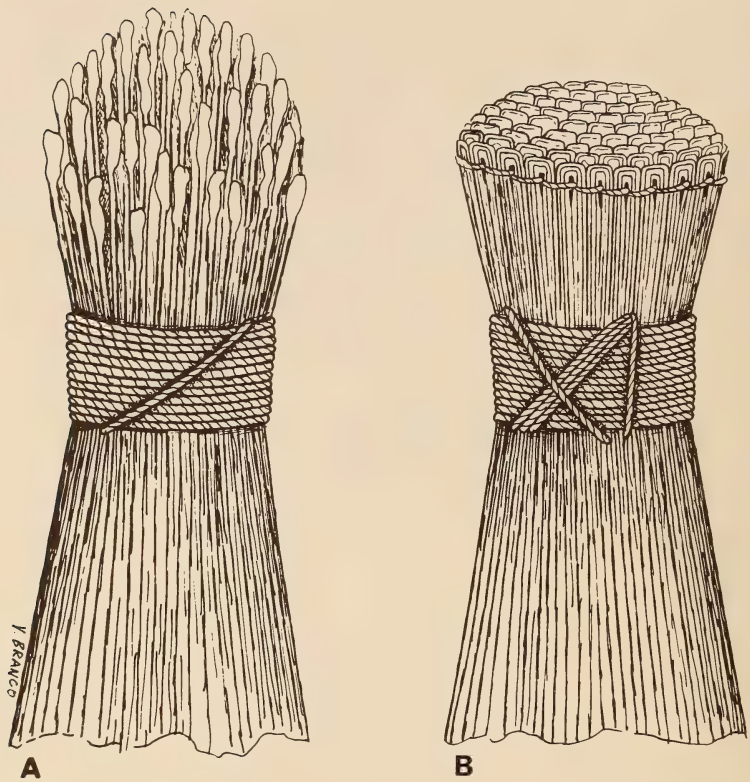


Fig. 37. Two types of broom. A. *Lefiêlô* made of grass pulled out by the roots. B. Grass twined and bent over before being bound to form grip of broom.

string. Grass brooms are still made by women during the season when the grass is available, and they are in general household use.

Cordage and spun thread

Lenti is string or cord made from plant fibres. It is made by both men and women but traditionally it was made mainly by men.

The choice of specific barks, creepers, fibrous leaves or roots depends on the intended use. The quality of the fibre is taken into account and it is prepared accordingly. Certain bark and bast fibres, for example *moga* (*Acacia rehmanniana*), produce very strong lashings suitable for structural work; other fibres, such as *moleţe* (*Triumfetta pilosa*) have pliability suitable for basketry. Strips of palm or banana leaf make adequate temporary lashings for tying bundles but would not be durable enough for use in hut-building. Other fibres recorded for making ropes and string include *mokhôba* (*Dombeya rotundifolia*), *mothanari* (*Colophospermum mopane*), *motswiriri* (*Bauhinia galpinii*), *mofwara tsweni*

(*Grewia* sp.), *mothala malagani* (*Acacia karoo*), and *mokhôda* (*Sansevieria* sp.).

Many barks are cut into strips and used as lashings without further preparation. If collected in advance, the strips are rolled into balls or bundles and stored until required. Before use, dry brittle bark-fibre is soaked in water or may be boiled to strengthen it.

String is made by separating the fibres of the chosen bark or plant and twisting the fibres together by rolling them by hand on the thigh or calf (Fig. 38). The

Fig. 38. Woman rolling sisal string, Modjadji's village, 1975.

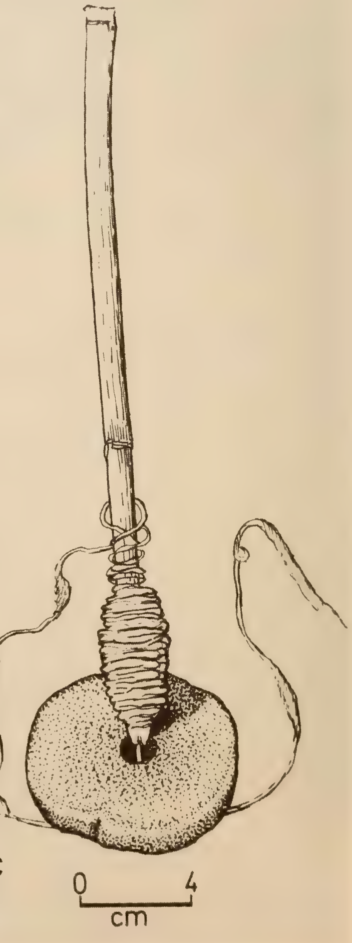
deftly executed rolling action, *-hoṱa*, is in two directions, both backward and forward. Two or three lengths of string may be twisted into two- or three-ply cord, following the same method.

The introduction of cultivated sisal, *Agave americana* (also *mokhôda*), made it more readily available than the indigenous fibres and this, together with the ease of working with the fibres, has resulted in its replacing most other materials for making rope and string.

Formerly wild cotton, *legudu* (*Gossypium herbaceum* var. *africanum*) (Fig. 39A), was spun by men into thread and plaited into girdles or necklets by women. Krige records that in the 1930s cotton was spun on spindles (Fig. 39B–C) weighted with ceramic whorls, *kheritswana*, and that there was considerable demand for handspun thread, *ledede* or *letshida*, which was used for the ties on skin skirts and baby-slings as well as for necklets. By the 1970s bought thread had replaced handspun cotton, spinning was remembered only by a few old men, and pieces of handspun thread were treasured as heirlooms.

A

B



C

Fig. 39. A. Wild cotton growing near Modjadji's Nek, 1973. B. Lobedu man spinning cotton. Photo: E. J. Krige, 1936–8. C. Spindle with ceramic whorl, SAM–9772, Krige Collection, 1936–8.

Headpads

Bundles of grass shaped into the form of a ring and bound roughly with any plant fibre such as grass, bark, or banana leaf are used to support heavy loads carried on the head. A headpad, *khare*, may also be made of a rolled-up piece of cloth serving the same purpose.

Nests for hens

A nest, *khetutu*, for hens is made by coiling and sewing bundles of *mohalana* grass (*Rhynchelytrum repens*) to form a sphere and cutting out an opening for the entrance. Nests would be placed on a high platform to keep the hens out of reach of predators at night. The keeping of hens is a Tsonga practice that has been gradually adopted by the Lobedu but not without some resistance. This was strongest in the royal village and even today, although many people elsewhere in the Lobedu area keep hens, they may not be kept at the capital.

Another kind of hen-house, recorded in the 1930s, was a small, conical grass structure bound with grass at the apex. A stone was placed over the opening to close the entrance. This was not seen at all in the 1970s.

Thatching

Thatching is a seasonal activity that takes place after June when the grasses are ready to be picked and before the rains start in late October. Women gather the grasses in large bundles (Fig. 40A) and men do the thatching. The old way of doing this was simply to lay the grass on the roof framework of closely packed rafters, to tie down the first layer of thatch at the lower edge so that the roots pointed downwards, and thereafter to place the other layers of grass on top with the roots facing in the opposite direction so that they interlocked with the lowest layer. *Letshumelo* grass was used for this kind of thatching (Krige 1982 pers. comm.). Withies or grass rope may be placed on top to hold down the thatch more firmly (Fig. 40B).

The modern thatching-technique is to sew the grass on to the rafters with a long needle, *lemao*, made of a hard wood such as *morêjê* (*Dicrostachys cinerea*). Work starts at the apex of the roof. *Thazi* grass (*Hyparrhenia filipendula*) is considered the best grass for the first layer as it has a smooth stem that does not break easily. Thereafter other grasses are placed on top and sewn down. By suspending a small ladder from the roof pinnacle the thatcher can move around on the roof quite easily (Fig. 41). The sewn thatching-technique is said to have been adopted from the method used by white farmers.

Vuhwera and *vyali* costumes

Young men in the *vuhwera* (North Sotho: *bogwêra*) initiation, which is held concurrently with the girls' *vyali* (North Sotho: *baale*) (for full description see Krige & Krige 1943: 126–140), are taught by older initiated men how to make

A

B

Fig. 40. A. Woman carrying thatching-grass, Modjadji's village, 1973. B. Old type of thatched roof, Modjadji's village, 1975.

Fig. 41. Ladder used for thatching, Ramatswalela's village, 1975.

the elaborate grass costumes worn for dancing in the *vyali* courtyard (Figs 42, 44A). In February and March when the suitable materials are in season and have been collected in large quantities, costume-weaving is the main activity of the initiates. There is great emphasis on learning the special techniques and only those who can display their weaving skill may enter the *vuhwera* enclosure (Krige & Krige 1943: 139).

Many of the traditional materials used for the *vuhwera* costumes and for the bandoliers worn by *vyali* girls are associated with rivers and damp places that have symbolic significance related to the Lobedu concepts of order and disorder. Rain is the ultimate good and is symbolic of harmony and order in nature. By association cool damp places and the materials found there are thought to possess strong positive forces. The *maṭaṭe* bandoliers plaited from river grass (*Mariscus* sp.) are believed to enhance fertility as are the songs sung by the *vyali* girls to accompany the *vuhwera* dancers. The feathers adorning the head-dresses of the dancers come from a bird, *ṭaṭa medupi*, whose call is a sign of rain. Even in present conditions when substitute materials have replaced many of the

Fig. 42. *Mohwera* dancing in courtyard. Photo: E. J. Krige, 1938.

indigenous fibres, there is an awareness among conservative Lobedu of the symbolic importance of the traditional materials.

The following information was given by Simeon Modjadji in 1975. There are two types of *vuhwera* costume—a light one, *mamegwane*, worn when out in the bush hunting, and a heavier dancing-costume, *ṱhôgwa*. Both have loose fringed skirts, shoulder-bands and a head-dress but the dancing-costume is far more elaborate and has row upon row of grass cross-bands forming an immense chest and shoulder covering on which rests a crested head-dress adorned with feathers or fur (Fig. 43). Armbands, anklets and, in some cases, underskirts are made of lengths of grass twined together to form flat bands. *Thazi* grass (*Hyparrhenia filipendula*) which has a smooth glossy stem, is the basic material used for all parts of the costume except the skirt, which is made from strips of *molala* palm leaf. Two-ply fibre string is used to join the pieces of grass together in a special twining technique referred to as *khavhe* (Fig. 44B). This kind of twining is used for the shoulder-bands, *mofhaga*, the arm- and legbands, *zwifhôdô*, the head-dress, *ṱhôhô*, and for all other parts of the costume except the skirt, *modjavhe*. This is made by knotting long strips of palm leaf on to a rope girdle that, when worn, is wrapped round the waist in layers.

Towards the end of the *vuhwera* the initiates spend most of their time going about to dance at different villages on the invitation of the headmen, or at the

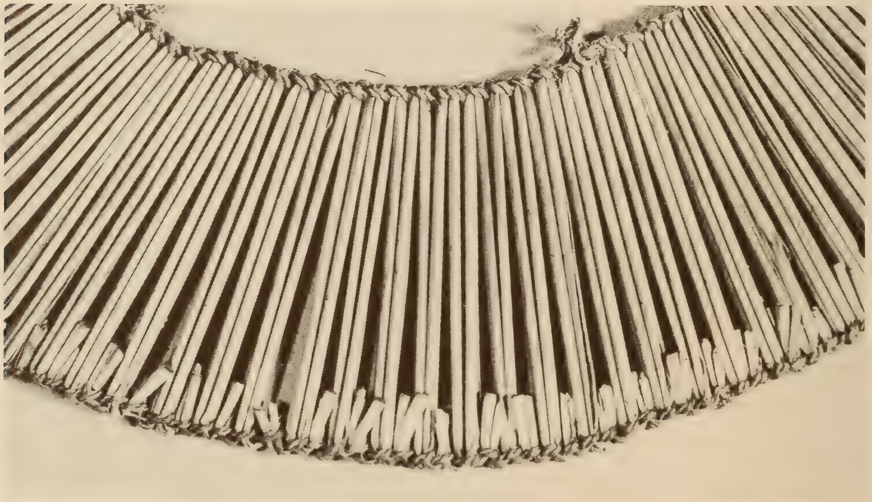
Fig. 43. Elaborate costumes worn by the *magôgôbya* during the 1938 *vyali–vuhwera* initiation. Photo: E. J. Krige, 1938.

capital to pay respect to Modjadji. The costumed dancers perform in pairs or singly, accompanied by drumming and singing of the *vyali* girls. During the *vuhwera* dancing the skirt flaps rhythmically, but the weight of the entire costume restricts the dance to slow graceful movements. The wearing of the heavy costume abrasive to the skin of the wearer is part of the ordeal that initiates must endure. The overall effect is an imposing spectacle much enjoyed by the onlookers who reward their favourite initiates with gifts of ornaments or snuff.

In the 1938 initiation the most spectacular costumes were worn by the *vahwera* of Rabothada whose performance at the capital traditionally closed the initation. Their dancers, the *magôgôbya* (Fig. 43), had magnificent costumes with head-dresses surmounted by animal figures, and had underskirts trailing the ground with dramatic effect. According to Krige (1982: 8) these costumes represented the finest weaving-skills.

The costumes worn in the *vuhwera* of 1974, which was the next school held on a national scale after 1938, displayed a deterioration of weaving-skills. The elaborately costumed *magôgôbya* did not appear at all as it was said that no one knew how to make the costumes (Krige 1982: 8). The *vuhwera* costumes worn in schools run independently by headmen, but with the permission of Modjadji, also revealed a decline in craftsmanship.

A



B

Fig. 44. A. *Mohwera* dancing to accompaniment of *vyali* girls, Molototsi valley, 1973.
B. Detail of technique used in *mohwera* costume.

Vyali girls do not wear elaborate costumes at any time during the initiation. During the early stages they wear only short wraps round the hips. Formerly these were made of hard, unworked skins but in the 1938 initiation cotton cloth was substituted (Krige & Krige 1943: 133) and has continued to be used instead of skin. At a later stage the girls wear bandoliers (Fig. 44A) plaited from *leṱaṱe* grass and, according to Krige & Krige (1943: 136), dancing skirts, *dali*, were made of a special kind of reed strung together in pieces about 2,5 cm long; they were used at both the 1938 and 1974 *vyali* (Krige 1982: 9).

An essential aspect of the *vyali* and *vuhwera* is the revealing of *digôma*, mysterious figures or objects unknown before initiation. These have not been seen by the writer but, according to Krige & Krige (1943: 135), in 1938 many of the *digôma* were masked figures in costumes made of grass, reeds or leaves. These masked figures were connected with mummery or verbal formulae, each with an esoteric meaning.

Khiuḓogane, the Bird of Muhale, is the greatest *gôma* and ruling spirit of the *vyali*. It appears in the moonlight wearing a strange costume consisting of a conical wooden framework similar to the structure of a hut roof. From this framework, which rests on the shoulders of the crouching wearer, hang long strings of blackened fibre. The fibre of the *moga* tree (*Acacia rehmanniana*), which becomes black when soaked in water, was traditionally used but more recently this has been replaced by sisal fibre blackened by rubbing with charcoal. The knot by which the strings are attached to the framework is the same as that used to attach the fringes of the initiation skirt to the girdle (Fig. 45). At the pinnacle, *ṱhôhô*, there is a small sphere of wood coated with black resin in which red seeds and a feather are embedded. The Bird is believed to come from a pool in the river and the *vyali* girls sing its praises even when it does not appear in the moonlit courtyard. It may communicate its commands at a distance by whistling through a special instrument, *mphenyi*, made of a reed pipe stopped at one end with a membrane from a spider's web (Krige 1982: 27). The Bird arrives only when food is plentiful and may be seen as the embodiment of fertility (Krige &

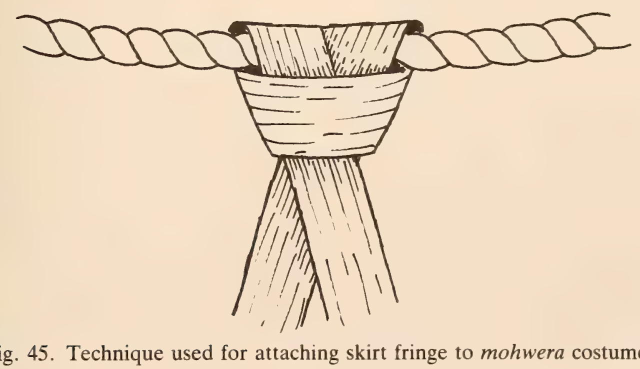


Fig. 45. Technique used for attaching skirt fringe to *mohwera* costume.

Krige 1943: 135, 139–140). The entire *vyali*, which spans a full agricultural cycle, is at one level an initiation for girls and at another level a fertility and rain rite.

For comparative data on the Kgaga *bogwêra* and *baale* initiation schools, which have many elements in common with the Lobedu, see the recent analysis by Hammond-Tooke (1981: 55–82).

WOOD AND REED

The indigenous environment is rich in trees and traditionally provided a wide range of woods for carving, for constructing huts, granaries and livestock enclosures, as well as for fire-wood.

Integrated with a practical knowledge of the natural vegetation, was the Lobedu concept of order in nature as something controlled through the power of medicine and magic, through the ancestors, through the divinity of the Queen, and through the mysteries associated with fertility (Krige & Krige 1954: 68). Certain woods used mainly for medical or magical purposes, for example woods used for the protective wand buried across the entrance to a village or for the medicated pegs around the perimeter, could not be brought into the village for secular use as this would reduce their supernatural potency. The same taboo applied and still applies today to the trees associated with shrines and the wood from which charms, *dithugula*, are made (Krige & Krige 1943: 167). The *movilô* (wild medlar, *Vangueria infausta*), the *moludu* (white stinkwood, *Celtis africana*) and *kherale* (*Gardenia jovistonantis*) are widely believed, not only among the Lobedu, to have magical properties (Palmer & Pitman 1972: 203). *Kherale* was one of the woods used for the medicated pegs (National Open Air and Cultural History Museum, ET 62/7, collected near Duiwelskloof) which were used, together with medicines, to protect villages from evil spirits. Twigs from the *khadi* creeper (*Adenia gumnifera*), which contains much moisture in its stems, were used for making brushes for sprinkling 'cooling' medicines in rituals of purification (Krige & Krige 1943: 274).

Symbolic associations of certain trees are important in understanding their uses. The vitality, luxuriant growth and abundant fruits of the *Celtis africana* are positive qualities that give the tree protective powers. The lush fruits of the marula (*Sclerocarya caffra*) and the wild-fig (*Ficus sansibarica*) are the epitome of fertility, apart from being edible and rich in essential proteins. An infusion of *Cussonia spicata*, a species with swollen underground roots, is used by Lobedu mothers to make their babies fat and strong. The great wild-fig trees shading shrines have 'cooling' properties, as do the succulent bulbs used in the rite for removing the impurity or 'dirt' (*khetshila*) of death (Krige & Krige 1954: 69).

The Ḓaja forest in which royal chiefs are buried is held sacred and it is a serious offence to cut wood there (Krige 1931: 210). This taboo applies also to *Moholwe* where the sacred drums are kept and, in general, to all burial sites. The felling of trees here would cause the anger of the ancestors. Certain members of the community who have died unnaturally are buried in wet soil under

overhanging trees near rivers, in order to 'cool' their 'heat', which contaminates the earth and causes drought. If the trees around these graves are desecrated, even by accident, a ritual of purification must be performed. These beliefs are still held even among converts to Christianity as shown by a purification ritual, *phuphutshêla madiba*, witnessed in 1973. A schoolteacher, who had accidentally started a fire that spread to a burial site and burnt many trees, had to sacrifice a sheep and be sprinkled ritually with 'cooling' medicines containing, among other things, rain-water and the undigested stomach contents of the sheep. A bunch of *khadi* twigs was used as a brush. The burnt graves were also treated with medicines. This was necessary to appease the ancestor spirits and prevent them from sending wind that would dispel the rain clouds.

Although important in understanding the Lobedu concept of their natural environment, taboos on the use of specific woods did not seriously restrict the technology as they applied only to a small fraction of the many available woods.

Wood-working techniques

'For each of the crafts—hut-building, fencing, making stamping-blocks, sledges, hoe-handles, milk-pails, spoons, platters, winnowing-baskets, drums . . . different qualities in the wood are regarded as important' (Krige & Krige 1943: 47). *Morididi* (leadwood, *Combretum imberbe*), for example, was known to yield charcoal of great enough heat for smelting iron, and *mbidibidi* (*Ekebergia capensis*) was valued for its soft light wood that was easy to carve. Hard, termite-resistant woods such as kiaat and mopane were selected for structural work and, although difficult to carve, for pestles and spoons that would wear down too quickly if made of softer wood. Even the everyday task of collecting firewood for the hearth required a knowledge of which woods burnt quickly or slowly, which smoked a lot, and which would produce long-lasting coals.

The choosing of a suitable wood was, in fact, one of the most skilled aspects of wood-working. The preparation of wood for carving and the actual carving techniques were, by comparison, less demanding. Wood was seldom seasoned before use and most objects were carved from the solid without need for joinery.

The traditional tool-kit consisted of an adze, *bêḓwana*, a poker, *morô*, and a number of gouges, *mahôrô*, of varying size each handled in a particular way (Fig. 46). Before contact with white traders, iron was obtained through trade with neighbouring people, notably the Phalaborwa and the Venda, and tools were forged locally. For many years now scrap metal, motor-car springs and files have been heated and hammered into blades for tools and hafted in the old way. More recently modern tools have come into use and axes, saws, chisels, penknives, and drills are used by those who can afford to buy them. The traditional tools, however, were well designed for their many uses and they have not been replaced. It is common to find hand-made tools used concurrently with bought tools (Fig. 47). Modern tools have made the felling of large trees much easier than in the past when it was necessary to make a fire at the base of the trunk and gradually cut through the burnt layers of wood.

Fig. 46. Woodcarver making a dish, *delô*, using a long-handled gouge with a bent blade. Note the characteristic position in which he is sitting while supporting the dish against a log of wood and holding it with his feet. Photo: E. J. Krige, 1936–8.

Traditionally there was some degree of specialization in the making of objects that required particular skill, but in general most men could make domestic utensils and handles for tools (Krige & Krige 1943: 50). Even skilled craftsmen were not full-time specialists and they seldom specialized in making only one type of object. It was not uncommon, however, for a man or a family to win a reputation for excelling in making particular objects.

Drums and mortars that required the felling of a tree were usually only made to order by craftsmen who possessed the necessary tools and expertise.

Fig. 47. Traditional and modern tools used by Calvin Ramatswalela, 1973. Left to right: purchased axe, traditional adze and three gouges, modern chisels, files, and knives.

Smaller objects such as dishes and spoons were more generally made. If a man had time to carve in excess of his own needs or was commissioned, he would exchange wooden objects for grain or sell them at the local market. Seasonal activity regulated both the practice of the craft and the demand for specific products (Krige & Krige 1943: 32). At the peak of the agricultural season craft-work came to a standstill and during the latter part of the dry season rebuilding and rethatching of huts took priority over other craft activity.

Most wooden utensils had a relatively long life-span and seldom required replacement unless attacked by termites. In the absence of a developed trading system there was no stimulus for surplus production and local demand was not great enough to support full-time specialists.

Since the 1930s, wood-working has become less generally practised. Restrictions on the felling of most indigenous trees has limited the legal use of certain woods and the pole-and-daga method of hut-building is no longer used. The demand for wooden stamping-utensils declined as the economy became increasingly dependent on purchased maize-meal. Furthermore, migrant labour reduced the number of potential craftsmen. The men remaining in the villages tend to be the unemployed, the elderly and the disabled. Through necessity some of these men have become woodworkers, carving traditional objects for sale as well as non-traditional objects to supply new demands deriving from changing social and economic conditions.

Uses of wood and reed

Domestic equipment

1. *Dishes*

Wooden dishes, *didelô* (Fig. 48A), or platters made from soft woods such as marula (*Sclerocarya caffra*) or *mohoo* (*Ficus sycomorus*) were traditionally used for serving cakes of porridge.

The rough shape was carved with an adze and thereafter hollowed out and finished off with a gouge, *lehôrô*. The ridges made by this tool are clearly visible on new dishes but they become smooth through use. The rim usually has a lip and the base may be thickened or raised to prevent it wearing through from use

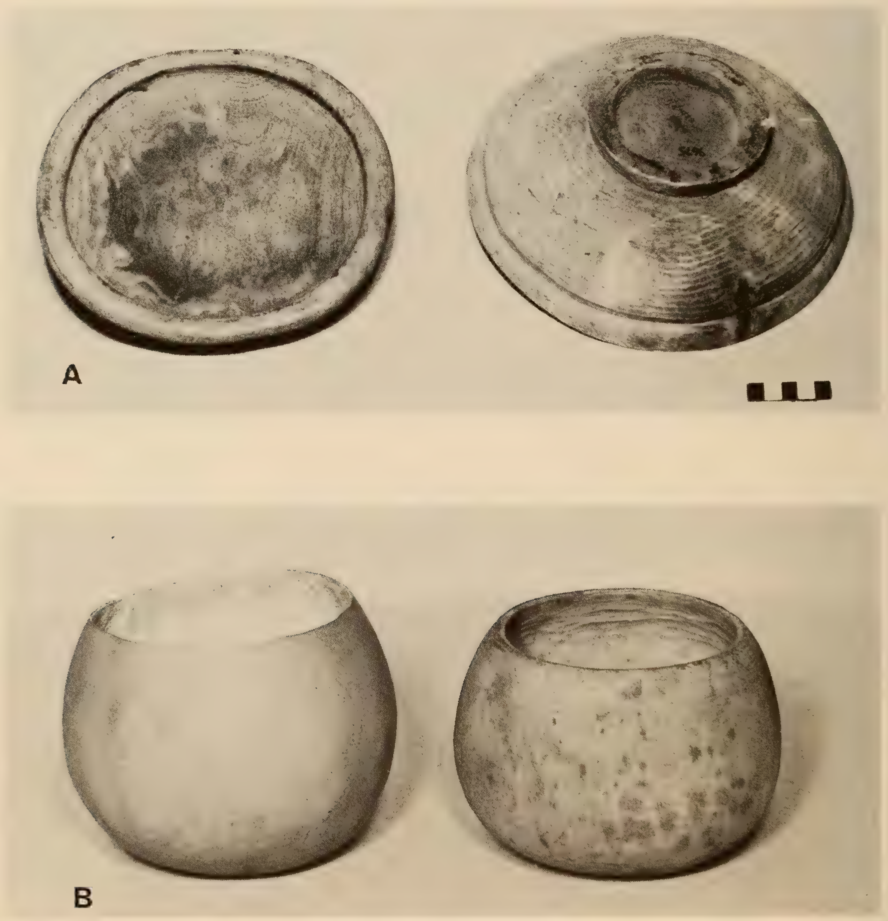


Fig. 48. A. Wooden dish, *delô*, SAM–9675. Underside shows the marks left by the tool, *lehôrô*. B. Calabash vessel and wooden imitation, SAM–9686 and SAM–9695. (All Krige Collection, 1936–8.)

on the ground. Repeated washing and scouring with abrasive sandstone gives used dishes a smooth finish.

Demand for wooden porridge dishes has declined but they are still occasionally made and used. Many families use the calabash *khethêba*, made by women, for the same purpose. An interesting wooden vessel in the Krige Collection is carved to resemble the shape of this type of calabash vessel (Fig. 48B).

2. *Milk-pails*

Milk did not form an important part of the Lobedu diet and the need for milk-pails, *dikhamêlô* (Fig. 49), was, therefore, not great. During fieldwork in

Fig. 49. Herd-boy holding a milk-pail, *khamêlô*. Photo: E. J. Krige, 1936–8.

the 1970s pails were not seen being made but, according to woodworkers who had made them in the past, soft woods such as marula or wild-fig were most suitable as they did not easily crack. Other woods mentioned were *mbidibidi* (*Ekebergia capensis*), *morula moobyani* (*Lannea discolor*) and *mobḙda-khamêlô* (not identified).

Two types of milk-pail are represented in the Krige Collection. A cup-shaped pail (Fig. 50) referred to as *ṱhôhô-ya-tshwene*, literally 'head of baboon', is the older form of pail and is similar to early Venda specimens (Van Warmelo, in addendum to Curson 1932: 58). This type of pail was rarely seen in the 1930s but the taller, narrower pails (Fig. 50) were still in use concurrently with purchased buckets (Krige notes).

Fig. 50. Two types of milk-pail: *khamêlô*, SAM–9716; and *ṱhôhô ya tshwene*, SAM–9718. (Both Krige Collection, 1936–8).

3. *Mortars*

Woods ranging from soft to very hard are used for mortars, *mafudu* (Fig. 51). A soft wood has the advantage of being light to move and easy to carve but has the disadvantage of wearing down and weathering quickly; hard wood is difficult to work but more durable and resistant to termites. Woods used by carvers interviewed in the 1970s included *marula*, *motômê* (*Adina microcephala*) and *mohoo*. A carver often took his tools into the bush to work nearer the source of the wood. Once the tree had been felled a block of suitable size was cut from the trunk with a saw and was carved very roughly with an axe. The mortar was shaped with an adze and gouge, and the hollow was chiselled out

Fig. 51. Woman using a wooden mortar and pestle for stamping maize. Note the winnowing-baskets used during the stamping-process and the grain spread out to dry in the courtyard. Molototsi valley, 1975.

with a long metal tool often made from part of a ploughshare. The finishing was done with a small adze and *lehôrô* gouge. Finally a file or sandpaper was used on the surface.

Where women still stamp maize by hand, mortars have remained in use and the porridge made from this meal is much preferred to that made of bought maize-meal. Furthermore, the different stages in stamping and winnowing produce meal ranging from a coarse to a fine texture, which gives variety to the staple diet (see p. 78) and the whole-kernel grain is far more nutritious than the refined product sold in the shops. None the less, pressure on land has resulted in most families having to depend on bought maize-meal. The frequency of stamping maize at home is consequently much reduced.

Although ubiquitous in the 1930s, the free-standing mortar, *lefudu*, was introduced into the Lobedu area by Tsonga-speakers. Mortars were widely adopted but until the 1950s were not allowed to be used inside the capital because of their Tsonga association (Mantwa Modjadji 1981 pers. comm.). During the 1930s there was a special area outside the capital where women stamped maize in these mortars (Fig. 52).

The older method was to stamp grain in a hole in the ground in which a hollowed block of wood was set (Krige 1982: 16). The women worked in kneeling position. This method was well suited to the stamping of sorghum and millet but was not as effective for stamping hard maize kernels. The practical advantages of the *lefudu* mortar for pounding maize seem to account for its widespread adoption.

Fig. 52. Women stamping maize in wooden mortars outside Modjadji's village. Note the large number of mortars in use, reflecting the supply of maize, and the use of winnowing-baskets. Photo: E. J. Krige, 1936–8.

Fig. 53. Women using wooden pestles to thresh millet in the fields. The hollow in the ground has potsherds embedded in the base to give it a hard surface. Photo: E. J. Krige, 1936–8.

4. *Pestles and beaters*

Long heavy pestles, *mese*, are used for stamping maize in a mortar and in the 1930s were used for threshing grain in hollows in the ground (Fig. 53); shorter pestles are used for stamping nuts in small mortars and for pounding clay on a stone before use (see Fig. 4A). Woods specially favoured for this purpose are *mokwalô* (*Acacia nigrescens* and *Acacia polyacantha*), *mothanari* (*Colophospermum mopane*) and *morididi* (*Combretum imberbe*). In general a pestle is made of a heavier wood than the mortar. A large club head is shaped at the upper end to give it additional weight.

A lighter pestle, *kherêgêlê*, used for grinding tobacco into snuff (Fig. 54), is a straight branch tapering slightly at the grinding-end. It is used with a clay pot that has a striated inner surface (see Fig. 14 and p. 66).

A short-handled beater, *khevhadô* (Fig. 55), with a flat working-surface is used for compacting floors and ledges of huts and courtyards. Some potters use this tool to shape the pot when it is leather-hard. A *khevhadô* is usually made in

Fig. 54. Snuff being ground using a pestle, *kherêgêlê*, and a pot with inner striations (see Fig. 14), Modjadji's village, 1973.

Fig. 55. Floor beater, *khevhadô*, SAM–9726, Krige Collection, 1936–8.

hard fine-grained woods, such as the *Combretum* species, so that it does not wear down easily.

5. *Spoons*

Spoons, *mafô*, used for stirring and serving food are made from a variety of fairly hard woods. *Moataba* (*Pterocarpus rotundifolius*, round-leaf kiaat), is specially favoured as its branches are usually straight and thin; *mosese* (*Peltophorum africanum*) and *moila khipala* (not identified) are also used but marula and wild-fig are considered too soft to make durable spoons.

Lobedu spoons (Fig. 56) have almost flat bowls and they are not used as eating-utensils or for handling liquids. The main use of the larger spoons is to

Fig. 56. Spoons and stirrer stored under eaves, Molototsi valley, 1975.

stir porridge as it thickens and to serve the stiff porridge from the cooking-pot into calabashes or wooden dishes in smooth, evenly rounded cakes. The rim round the bowl of a spoon used for serving porridge prevents the hot porridge from running over the sides and allows a smooth cake of porridge to be formed (Krige 1981 pers. comm.). Spoons without rims are used mainly for stirring or scraping down the sides of the cooking-pot. Smaller spoons are used for preparing relish in fairly small pots.

Wooden spoons are still made and they are in daily domestic use. Washing with abrasive sandstone eventually gives the spoon a smooth, seasoned patina.

6. *Stirrers*

The traditional stirrer or twirler, *lefhêṯhô* (Fig. 57), was made from *motômê* (*Adina microcephala*) wood. Young *motômê* trees have a central branch from which shoots radiate out in a whorl. The twirler was cut and

Fig. 57. Traditional stirrer, *lefhêṯhô*, SAM–9698, Krige Collection, 1936–8.

trimmed from the growing tops of young trees, which gave the utensil its typical form. A newer wire stirrer, *lefhêṯhô la darada*, is now popular. This is made from a straight rod of wood (usually *moataba*) with two wire rings attached at one end (Fig. 56).

A *lefthêṯhô* is used in the early stages of cooking porridge to prevent lumps forming when the meal is added gradually to a pot of boiling water. A woman rotates the stirrer between her palms so that the porridge is mixed with a rapid twirling action. When the porridge thickens she changes to the heavier *lefô*.

7. *Stools and headrests*

Stools, *zwidulo*, are made from any tree that has branches of appropriate natural shape. In the *khôrô* men sit on these seats while discussing village matters (Fig. 58A). In summer they are usually found under a large shady tree and in winter or cold evenings round the fire-place in the *khôrô*. Smaller stools,

A

B

Fig. 58. A. Men sitting on wooden stools in the *khôrô of Mambeolo*, 1975. B. Locally made 'riempie' chairs, Semosa's homestead. 1973.

carved from logs, are found in cooking-huts. Riempie chairs (Fig. 58B), based on those seen in farmers' homes, were made by some carvers in the 1930s and were still made in the 1970s.

The most common headrest, *kheseamêlô*, is simply a block of wood or a bundle of old rags placed under the sleeping-mat. Two carved headrests (Fig. 59A–B) were collected in the Lobedu area in the 1930s but such headrests

A

B

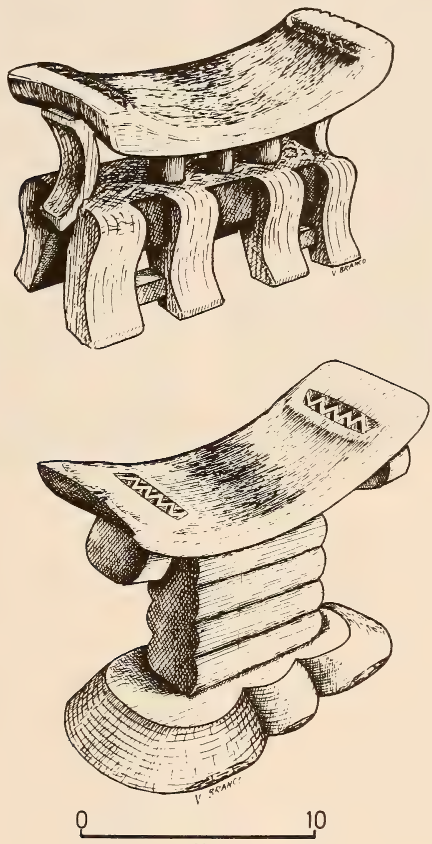


Fig. 59. Headrests, *zwiseamêlô*. A. SAM–9730. B. SAM–9731, made by a Tsonga craftsman. (Both Krige Collection, 1936–8.)

were not widely used. One is known to have been made by a Tsonga craftsman and present-day Lobedu woodworkers confirmed that carving of this nature was done mainly by Tsonga speakers.

8. *Strainers*

A wooden strainer for beer, *sefô ya hoṱhôḓô vyalwa* (Fig. 60A–B), is a fairly recent addition to Lobedu household equipment. It can strain much larger

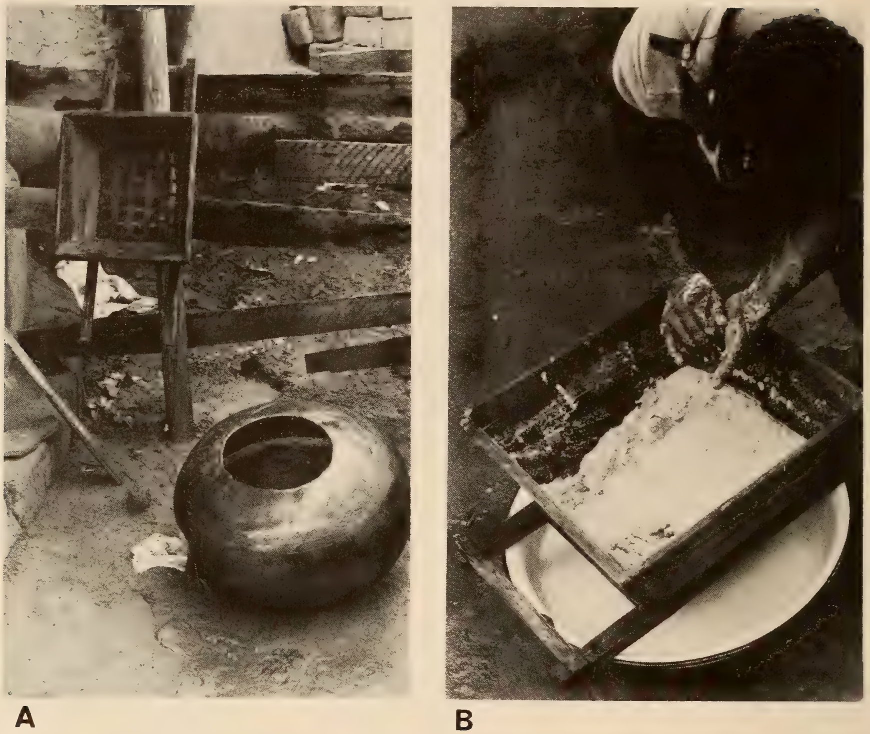


Fig. 60. A. Sieve, *sefô*, made of a wooden frame with wire-gauze stretched across the base, used for straining large quantities of beer; clay beer-pot in foreground. Modjadji's village, 1975. B. Sieve in use at Modjadji's village, 1975.

quantities of beer than the woven strainer, which it has largely replaced. An example (SAM–10881), purchased in 1976 from a craftsman who brought these strainers to sell at the market at the capital, is made of pine and blue-gum wood. Pine is used for the sides of the box-funnel and gum for the lateral supports and handle. The pieces of wood are joined with corrugated fasteners and nails, and strips of metal are nailed over the corners and side joins to give them extra strength. Wire-gauze and a lattice of pieces of hoop metal are nailed across the base opening to form the sieve through which the beer is poured.

This type of strainer is a modern innovation related to an increase in the brewing of beer for sale. In the 1930s the selling of beer was very uncommon and beer was generally brewed on a relatively small scale, preferably from sorghum or millet. The woven strainer (see p. 86) was used by wringing and squeezing the beer into an open-mouthed pot, *lebê̮da* (see p. 66). Beer was consumed at home and in a number of socially important contexts such as paying tribute, showing hospitality or gratitude, and honouring ritual obligations. This pattern of beer-drinking has continued to the present but, in addition, women now brew

beer for sale as it is a way to earn money at home. Maize-meal is bought at the store, often on credit against later payment when the beer is sold, brewed in large tin drums, strained through a wire-mesh *sefô* into another large metal drum, and served in glass jars or mugs of fixed volume. Thus the change in the pattern of brewing is reflected in the utensils used in the preparation and consumption of beer.

Hunting-equipment and weapons

Objects having wood or reed as a component are described here and referred to in other sections where relevant.

1. *Arrows*

Arrows (Fig. 61A–G) are distinguished according to their type of head: *mosêvhê wa phagane* is an arrow with a flat, unbarbed metal head; *mosêvhê wa mogôvhô* is an arrow with a long, straight metal head; *mosêvhê wa digôbe* (literally a fishing-arrow) is an arrow with a barbed metal head; and *thebola* is an arrow with a knobbed wooden head (Fig. 61F–G).

Arrow shafts were generally made of reed into which the tang of the head was fitted and the join bound with sinew, bast or stripped creeper. A hard wood such as *mosese* (*Peltophorum africanum*) was used for the knobbed head of the *thebola*, which was used in hunting birds and small buck.

2. *Bows*

Formerly the bow, *vhora*, was the principal weapon in warfare and in hunting. Both these activities had ceased by the 1930s.

Mofwaṭa (*Brachylaena transvaalensis*), which was considered a particularly good wood for making bows (Krige notes), is described by Palmer & Pitman (1972: 2149) as 'strong, elastic and durable'—ideal qualities for the purpose. Examples in the Krige Collection have staves, rounded in section, which taper from the grip to the slightly shouldered ends. The string of twisted thong is fastened to each end with a knot (Fig. 62).

By rubbing the stave with fat it was kept pliable, and in cases when repair was necessary the break or crack was bound with wire and covered with a piece of cow-hide (SAM–9836, Krige Collection).

3. *Clubs*

Wooden clubs were not part of Lobedu material culture. The term *thôga*, a club, is a Lobedu rendering of the Tsonga term *nhonga*, and the weapon was never widely adopted by the Lobedu (Krige 1983 pers. comm.).

4. *Hafts of tools and weapons*

Weapons and tools used for a variety of purposes were hafted in wood. Fairly hard woods were selected for this use as it was important that the wood should not crack easily. *Moataba* (*Pterocarpus rotundifolius*) and *morôdô*

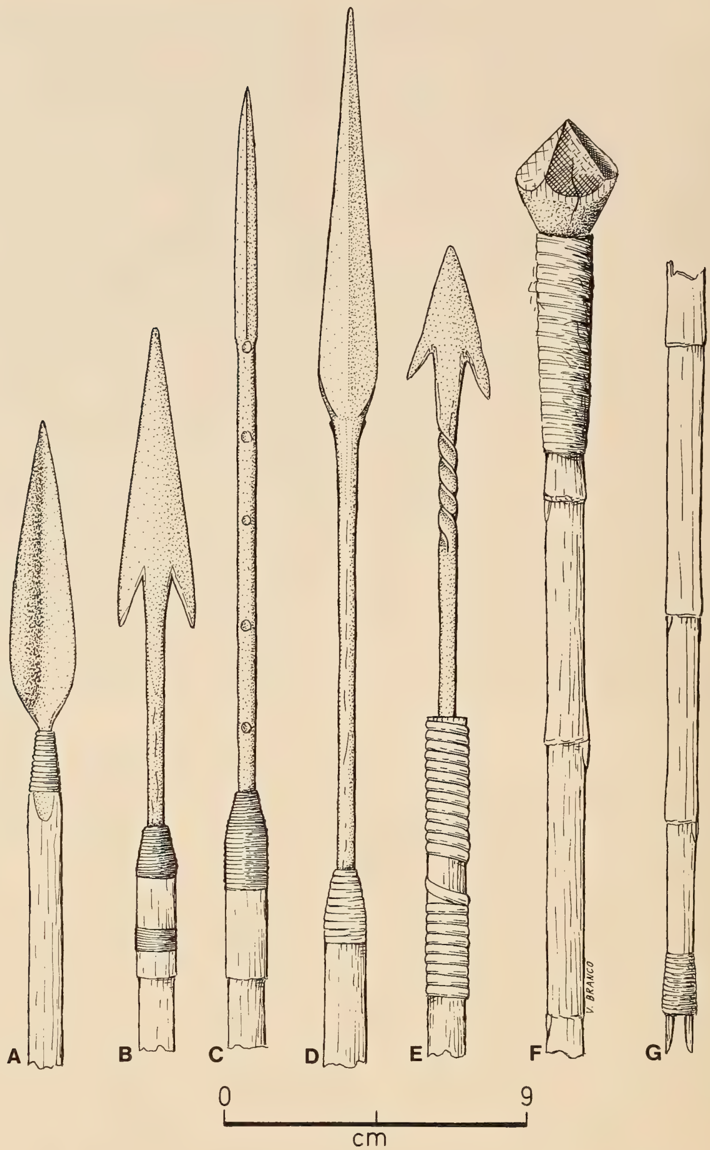


Fig. 61. Types of arrows. A. Unbarbed arrow, *mosêvhê wa phagane*. B, E. Barbed arrows, *mosêvhê wa digôbe*. C, D. Long-tanged arrows, *mosêvhê wa mogôvhô*. F. Wooden-headed arrow, *thebola*. G. Butt end of the *thebola*.

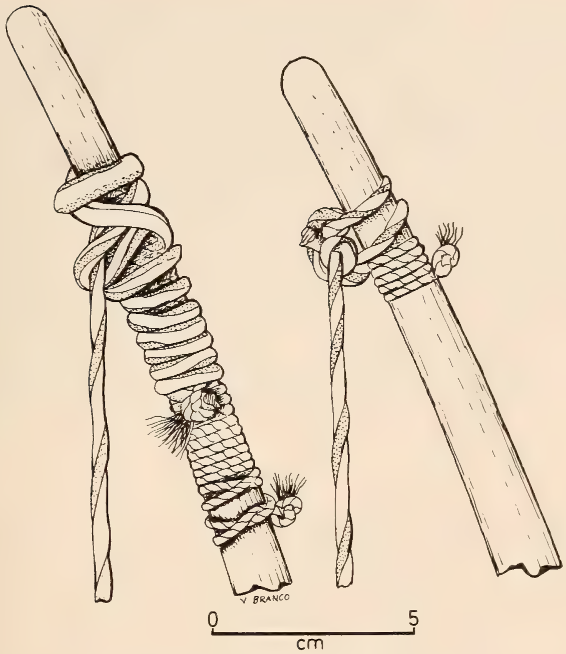


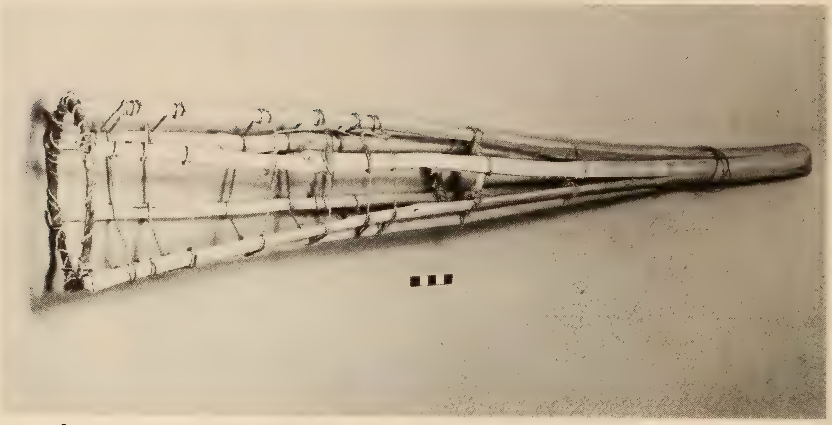
Fig. 62. Detail of bow-string attachment.

(*Pterocarpus angolensis*) were often used but many other woods were also suitable. The handle, *mofhenye*, was carved to the required shape and a socket for the attachment of the head or blade was burnt through the haft with a hot poker, *morô* (see Fig. 110A). When a man needed a new tool or weapon he would commission a specialist smith for the head and make the haft himself.

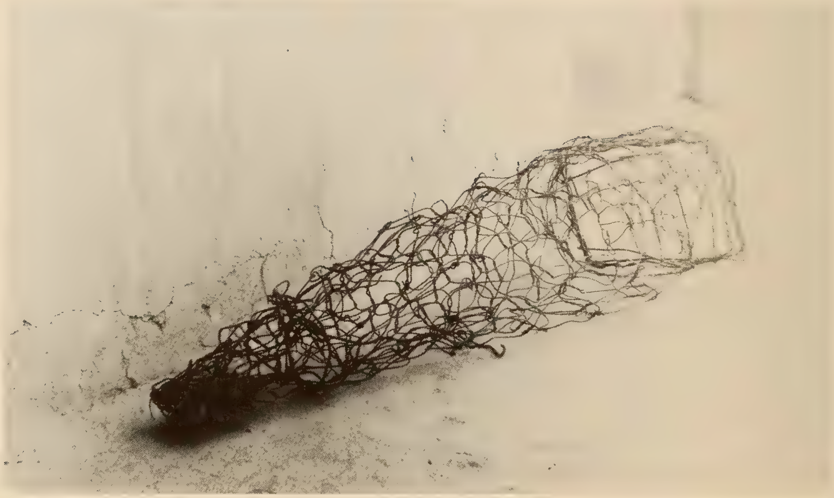
Hafts were generally undecorated but usually well proportioned in relation to the head and well balanced for handling. Occasionally a knife, *mofhaga*, had a band of decorative carving on the hilt (see Fig. 111A).

5. *Traps*

A cane-rat trap, *mothêma* (Fig. 63A), was made from a branch of *moloha* (*Acacia ataxacantha*) split into a number of sections for most of its length. The thicker end was left whole and the split sections were spread apart and fixed in position by being tied to graded wooden rings (made of pliable wood or creeper stem). The overall shape was that of a funnel. String was wrapped round the sticks and passed from one to the other to fill in the gaps that were large enough for a rat to pass through. Herd-boys placed the trap in the grass where rats, *magwelele*, were known to run, beat the bush to scare the rats into the trap and then killed them with a knife or a small spear.



A



B

Fig. 63. Traps for cane rats. A. *Mothêma*, SAM–9862, Krige Collection, 1936–8. B. Wire *mothêma*, Modjadji's village, 1973.

A modern version of the *mothêma* is made in wire (Fig. 63B). The opening of the trap has a flap that opens inward only so that the animal gets caught inside and cannot escape.

A trap, *khethêdêlê* (Fig. 64), for birds consisted of a ring of wood (a pliable stick bent into a circle and tied with bark) with a mesh of bark strips tied across it. Slip-knots made of the tail hair of an ox were attached to the cross-strips and the trap was covered with a thin layer of soil so that only the knots of hair were

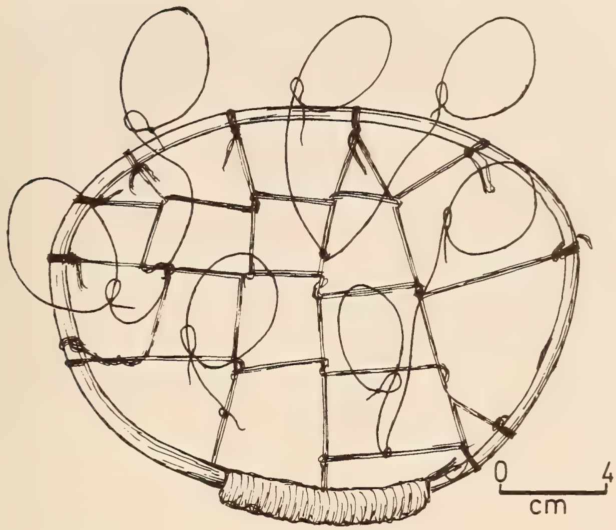


Fig. 64. *Khethêdêlê*, trap with slip-knots for catching birds, SAM–9863, Krige Collection, 1936–8.

visible above ground. Grain or seed sprinkled between the knots attracted birds and their legs were caught in the slip-knots.

The *mothêma* and *khethêdêlê*, as well as a number of other traps that involved the use of stones and string or pliable wood under tension, were made by herd-boys who spent much time in the veld looking for edible wild fruits or honey and making traps for birds and small animals. They were much less common in the 1970s than in the 1930s.

The trap for termites made in the side of a termite-heap using sticks and a clay pot was described in an earlier section (see p. 68).

Musical instruments

1. *Drums*

Drums played a significant role in public life and were played on many occasions of ritual and social importance. Drums were never individually owned. Every district head owned a set of drums and was responsible for their upkeep. When a new district head was appointed the chief handed over a drumstick as a public sign of his office (Krige & Krige 1943: 126).

Lobedu drums for secular use are of two types: *gôma* (Fig. 65A), a large drum with hemispherical resonator, played with a drumstick; and *thithimedzhô* (Fig. 65B), a long, cylindrical drum made in various sizes, played with the palms of the hands. Drums are made by specialists who take orders and receive payment for their work. In the 1930s in the Venda area the cost of a large drum of similar type to the Lobedu *gôma*, was an ox or its equivalent (Kirby 1934: 36).

A

B

Fig. 65. A. Large *gôma* and small *thithimedzhô* drums at headman Mohale's village, 1975. B. Large *thithimedzhô* drums on the verandah of a sleeping-hut in the special part of the capital used by Modjadji and her wives, 1976.

The cost in 1976 was in the order of R20 to R30 but less if the wood was supplied by the buyer. For making drums soft-wooded trees such as *mohoo* (*Ficus sycomorus*), *movhamba ngoma* (*Albizia gummifera*) and *marula* (*Sclerocarya caffra*) are used. The carving-tools are adzes and gouges of various sizes, and a long, flat piece of sharpened scrap metal is used as a chisel.

A *gôma* drum is made in the following way: the resonator is carved from a solid section of tree trunk and worked so that the long grain of the wood runs laterally across the drum and not vertically down its length. The resonator is hollowed out until the walls are about 2–3 cm thick, and a small hole is made in the centre of the base, which is thicker than the sides. A band of relief carving usually encircles the bowl at its widest diameter. The *gôma* in the Krige Collection has handles resembling interlaced loops carved at the four 'corners' and a band of carving between the handles. These features are characteristic of many drums from the Lobedu area and are also typical of the Venda *ngôma* described in detail by Kirby (1934: 34–38). Holes round the mouth of the resonator are burnt with a hot poker and a piece of wet cow-hide is stretched over the head and pegged into position through the holes. The hair is removed from a circular patch in the centre of the skin. An additional strip of hide with slits made in

Fig. 66. Drums being played by women at a *gôsha* dance. The men on the right are playing reed pipes (see Fig. 70). Photo: E. J. Krige, 1936–8.

position of the pegs is fastened round the rim to strengthen the attachment. Before the wet skin is stretched over the resonator a few river stones are placed inside the drum. According to Krige & Krige (1943: 221) the reason for this may be related to the 'cooling' quality of the stones. Coolness is perceived as a positive quality which can counteract negative forces. It is also likely that the conventional attributes of the *gôma* and the manner of beating it have special meanings and symbolic associations in specific social contexts and that many of these are related to chieftainship and to fertility.

Two or three cylindrical drums of different sizes are played together with the *gôma*. The longest and most important of these is *gaedisô*, which sounds the entry of solo dancers; the other two are both called *thithimedzhô*. All are played by women using the palms of their hands. They are not played in upright position but are placed on their sides and tilted upwards when being played (Figs 66–67).

The construction method for both *gaedisô* and *thithimedzhô* is the same. The wood said to be best for these drums is *morôdô* (*Pterocarpus angolensis*) but softer woods are also used (Jan Lebiya 1976 pers. comm.). The resonator is carved from a solid block of wood, the length of resonator following the grain. The tools used are the traditional adzes and gouges as well as a piece of sharpened scrap-iron used to chisel out the shell. Some, but not all of these drums,

Fig. 67. Women playing drums at a Saturday beer-drink near Molabisana's shop, 1973. Note the tin *gôma* on the right.

have a handle on one side. Holes round the mouth of the resonator are made with a hot poker, and pegs for attaching the skin are carved in a hard wood. As for the *gôma* drum a piece of wet cow-hide is stretched over the head and vertical slits are made to coincide with the positions of the holes for the pegs. A band of hide with horizontal slits in the position of the pegs is wrapped around the head and the pegs hammered into the rim through the slits in the two layers of skin. These drums are seldom decorated.

A frame-drum, *khethadada* (Fig. 68), played during *malôbô* spirit-possession rituals is made in the following way. A piece of wet goatskin, with the hair removed, is stretched over a broad hoop of pliable wood or metal (for example the frame of a bicycle wheel) and the overlapping edges of skin are cut into strips, twisted and tied on the underside to fasten the head in position and form the grip for the player to hold. Two or more *khethadada* 'tambourines', beaten with sticks, are played together with *tshêlê* and *mathodzi* rattles (see p. 153) and other drums to accompany the dancing of a possessed person and to encourage the spirit to manifest itself (Krige & Krige 1943: 243). The Tsonga cult of

Fig. 68. Frame drum, *khethadada*, and drumstick used to accompany *malôbô* dancing. Note attachment of skin on underside. SAM–9827, Krige Collection, 1936–8.

possession from which Lobedu *malôbô* practices derive has been described by Junod (1927: 479–504) and the associated musical instruments by Kirby (1934: 41–44). The cult among the Kgaga has recently been described by Hammond-Tooke (1981: 104–111).

In addition to the drums for secular use there are four sacred drums (*digômana*) that are held in great awe and are associated with the chief and the welfare of the people. The following information was recorded by Krige & Krige (1943: 126–127). The sacred drums are similar in shape to the ordinary *gôma* drum but they are played by hand instead of with a drumstick and their sound is believed to please the ancestral spirits. The largest of the four, *phaṱaṱe*, stands about 120 cm high, next in size is *ṱanga*, then *pekahare*, and *rangwedi*, the smallest but most important. All four drums are said to contain a human skull instead of the stone that is usually put inside a drum. In addition, *rangwedi* has strips of human facial skin placed under the ox-hide head and is smeared on the outside with *khetshila*, 'dirt' from the corpse of a person of noble blood who was killed for this purpose. The maintenance of the sacred drums, which involves treating them with fat and ochre to protect them from infestation by insects, the renewal of the skins, and the repair of the hut in which they are kept is the special task of the Rabothada family, which has historical links with Phalaborwa where the institution of sacred drums was strongly developed (Krige & Krige 1943: 127).

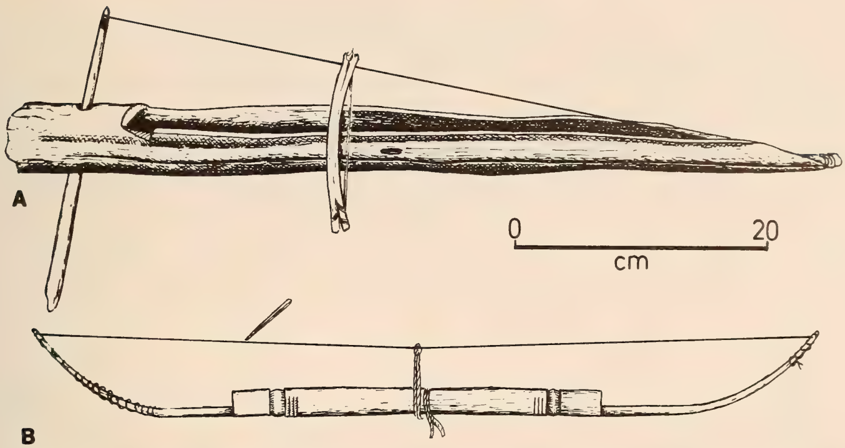
The sacred drums were played only on certain occasions of ritual importance, for example the *gômana* ceremonies, and unlike the ordinary drums they were always played by men. Their beating was associated with asking the ancestors for rain and with the seasonal cycle. So important were these drums that they were looked upon as having supernatural power (Krige & Krige 1943: 127). Although they are still kept in good repair, the sacred drums of the royal family have not been beaten regularly since the last decade of the nineteenth century and not at all since before the 1930s. The reason for this is said to be that killing for ritual purposes has long been prohibited by law and the necessary parts of a human body are thus no longer obtainable (Krige 1983 pers. comm.).

2. *Stringed instruments*

Kirby (1934: 196) grouped southern African stringed instruments into three general categories according to the fundamental tones produced and the harmonic sounds generated by these fundamentals. The Lobedu stringed instruments *khekhaba, khedzhôlô* and *khedôlôdôlô* (Fig. 69A–B) fall into Kirby's groups one, two, and three respectively.

The *khekhaba* is a musical bow in which the fundamental tone of the string and its harmonics are sounded as a chord. As the string is tied back near the centre it yields two chords, depending on which part of the string is struck. The bow is made of a well-seasoned branch with the bark removed. It is fitted with a string (of wire, twisted sinew or hair) tied back by a loop of wire, sinew or fibre near the centre. At this point a calabash resonator is attached to the bow. The

A



B

Fig. 69. Stringed instruments. A. *Khedzhôlô*, SAM–9819. B. *Khedôlôdôlô*, SAM–9821. (Both Krige Collection, 1936–8.)

string is struck with a thin stick or reed. It is usually played by unmarried men on its own as an accompaniment to a song (Kirby 1934: 207).

The *khedzhôlô* (Fig. 69A) is an instrument that is played so that certain harmonics of the string are isolated to produce a melody. The stave is usually carved from a branch of soft wood about 80–90 cm long and 6 cm in diameter. The bark is removed, a flat surface formed along one side of the wood, and the pith hollowed out, leaving one end solid. Through this end a hole is bored and a tapered peg fitted. A wire is attached to the upper end of the tuning-peg and to the opposite end of the wooden stave or sounding-board. A notch on the stave makes it easier to hold the *khedzhôlô* steady when in use. A small friction-bow for playing the instrument consists of a stick about 10 cm long with a string of tail hairs or plant fibre attached to notches at the ends of the stick.

The player holds the *khedzhôlô* with the open end resting on his left shoulder. A calabash or tin resonator is often placed over the end to increase the sound produced by stroking the wire with the bow held in the right hand, and varying the tension of the string with the left hand. Only men play this instrument, either alone or to accompany a song.

The *khedôlôdôlô* (Fig. 69B) is a musical bow in which the harmonics of the string are used in conjunction with their fundamentals to produce the melody. The bow stave, which is always thicker in the centre than at the ends, is constructed in one of two ways—it may be carved as a whole from a solid branch of flexible wood or the central part and the ends may be carved separately and then fitted together. In the latter case it is usual for two different kinds of wood to be used—a fairly soft wood for the thick section and pliable wood for the ends. In both cases the ends are bent to the required curve while green and allowed to dry in that position.

The string is tied to notches cut at the tips of the stave and a piece of cotton or sinew is attached near the centre of the string to draw it back towards the stave. It is wound round the stave to secure it in position. The mouth, placed at one end of the thick part of the stave, acts as a resonator and the string is plucked in various ways with a plectrum (a small stick or a thorn) to produce a number of tunes, often wistful or sad. It is played only by men or boys and sometimes the player sings an accompaniment. Formerly, if a young unmarried man played this instrument all night people knew he was longing for a wife (Krige notes).

3. *Wind instruments*

The playing of the reed pipe ensemble, *mothavha*, accompanied by drumming and the performance of the *gôsha* dance, was an important form of social activity and musical entertainment among the Lobedu. Although by the 1970s the inter-district *gôsha* dances associated with individual reciprocities had disappeared, those associated with dancing for rain at the capital or at the end of a period of mourning continued, albeit less frequently than in the 1930s (Krige 1982: 23). The number of reed pipes in a set can vary from more than twenty to less than ten. Each man plays a single pipe that has a fixed pitch and produces a single note, the longest pipe giving the deepest note. Each pipe has its own name denoting the part it plays within the ensemble and how it combines with other members of the set.

A set of twenty-two reed pipes (SAM–9812) collected in the 1930s is named and graded as follows (Krige notes):

1. *Ledzekha la pele*—the longest pipe.
2. *Lembo la dzusi la giba*—played after pipe 14 to introduce a song, *giba*.
3. *Ledzekha la gamorao*—played with 1.
4. *Ledzekha*—played with 1 and 3.
5. *Lembo la dzusi la vesa*—played with 2.
6. *Lembo*—played with 2 and 5.
7. *Ya ga ntau ha thakhudi*—played after 12.
8. *Lembo*—played with 2, 5 and 6.
9. *Moholo a khomo*.
10. *Khomo*—played with 9.
11. *Khomo*.
12. *Thakhudi*.
13. *Giba*.
14. *Dzusi ya giba*—awakens or heralds 13, starts the *giba* song.
15. *Tateledi*.
16. *Dzusi*.
17. *Dzusi ya vesa*—introduces the *vesa* song.
18. *Pegudi*.
19. *Thezwane*.

20. *Ya ga ntau a thezwane*—played after 19.
21. *Thezwane.*
22. *Khenthê kha dzusi a giba*—high-pitched pipe for 'rousing' or introducing 13.

Some of the pipes (Fig. 70) are made of cultivated reeds, *mothêkhathêbye*, which are stronger than the indigenous *mbaseriti* reeds formerly used for reed

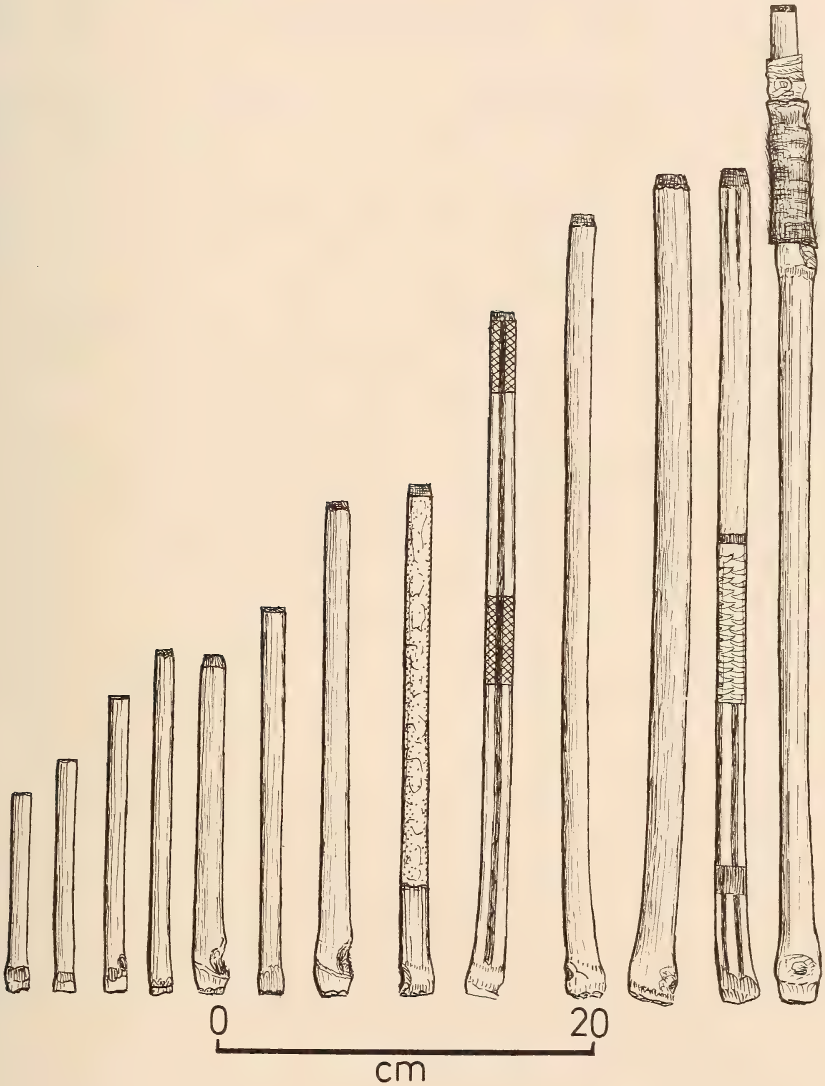


Fig. 70. Some examples of the pipes in a set of twenty-two reed pipes, *mothavha*, SAM–9812, Krige Collection, 1936–8.

pipes. Not all pipes in the set are made of this type of reed; nine are of a thinner reed, not identified. Lobedu reed pipes are made in the same way as the Venda pipes described in detail by Kirby (1934: 162). The reeds are cut to the required length so that a node forms a natural plug at the lower end of the pipe. To bore through intervening nodes a length of red-hot iron is used. If ornamented, the pipes are incised with a sharp knife. The pipes are tuned against each other and can be cut down to raise the pitch. A complete set of pipes is usually kept in a special skin bag, *saga ya mothavha*, and many of the pipes bear some distinguishing mark so that the player can easily recognize the pipe that he usually plays.

Reed pipes are played only by men, who dance in a circle while playing, causing the melodic illusion of changing sound sequences that would not occur were the players to remain stationary. The dance-master, *malogwani*, signals the start and changes in the pattern of the dance but in actual performance leadership changes continually as one dancer after the other takes the centre position in the circle of dancers. An accompaniment of drumming is played by women on a *gôma* and three *thithimedzô* drums (see Fig. 66).

In addition to the reed-pipe ensemble, there are a number of flutes and whistles made of bamboo or wood that are played on their own, especially by herd-boys. The term 'flute' is used here for pipes that can produce more than one note, and 'whistle' for those that produce only a single note.

The *kheṱhodigô* (Fig. 71A) is a transverse flute made of indigenous *mbaseriti* reed closed naturally at both ends by nodes in the reed. The embouchure near one end and three finger-holes near the other end are bored through the reed with a red-hot poker. A number of tunes can be played on this flute. The *rodigô* flute (Fig. 71B) is made from a length of *mbaseriti* reed open at both ends. The player blows over two V-shaped notches at one end and varies the tune by fingering the other end. The *lengwale* flute (Fig. 71C), made of wood, is played in the same way. The example in the Krige Collection is made of *morogôlô* wood (*Carissa edulis*) a fine-grained wood that does not split easily. A whistle, *naga*, made of horn, reed, or wood, is a pipe closed at one end and sounded by blowing across the open end. A *naga* (Fig. 71D) collected in the 1930s is made of wood shaped to resemble a horn and decorated with wire binding. A feather kept in the open end is used as a pipe cleaner.

A small vibrating wind instrument that has great ritual importance among the Lobedu is the *mantsaakhôḓa* (Fig. 71E), which consists of two pieces of wood wider at one end than the other and slightly concave on the inner surfaces, between which is inserted a piece of bark or any material that will vibrate when blown. Rubber was used in a specimen collected in 1970. The *mantsaakhôḓa* is surrounded by secrecy and is used by old men who impersonate the voices of the ancestral spirits, *zwidajane*, in certain religious ceremonies, for example the *thugula* harvest thanksgiving and the *khetshila* purification ceremony after the death of royalty. The spirits are believed to be hidden in the near-by bush and to express themselves by whistling. Messages are conveyed by varying the tone of the

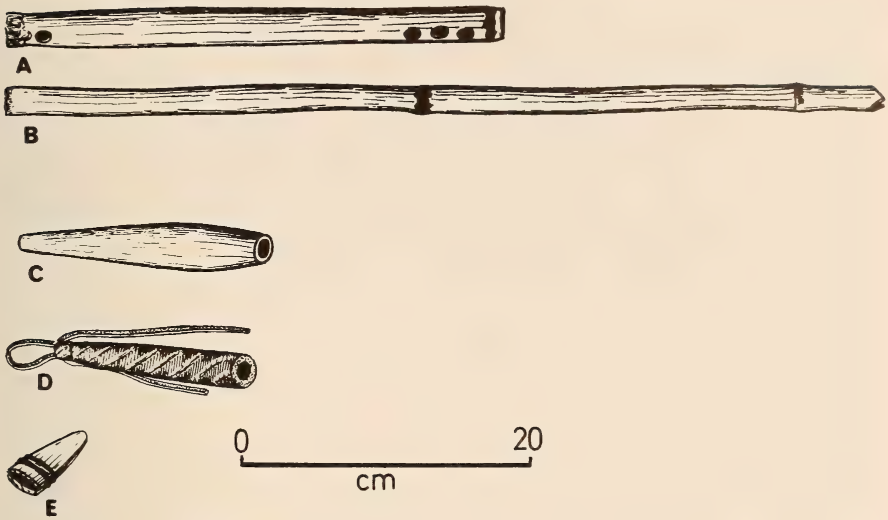


Fig. 71. Wind instruments. A. Flute, *khe̯thodigô*, SAM–9814. B. Flute, *rodigô*, SAM–9815. C. Flute, *lengwale*, SAM–9816. D. Whistle, *naga*, SAM–9817. E. Whistle, *mantsaakhôd̯a*, SAM–9824. (All Krige Collection, 1936–8.)

whistling, which can be translated into the tone patterns of the language. The *mphenyi* instrument played by *khiud̯ogane* in the *vyali* school (see p. 99) operates on the same principle. The vibration of the membrane across the end of the reed pipe produces the strange eerie sounds by which *khiud̯ogane* communicates.

Wind instruments made of horn are described in a later section (see p. 166). They include whistles and the horn trumpet, *phalafhala*, which is associated with authority and is blown to signal important announcements.

4. *Idiophones*

In the 1930s xylophones, *dibela*, with calabash resonators (see p. 153) were used in the Lobedu area by itinerant minstrels who played the xylophone and sang humorous songs in return for food and lodging (Krige & Krige 1943: 316). There is no record of xylophones being made by local craftsmen and it is probable that the instruments used were of Venda origin (Kirby 1934: 56).

Also in use in the 1930s was a plucked instrument, *deze*, consisting of a flat wooden resonator set under a series of iron tongues that were plucked with the thumbs to produce the sound. By adjusting the length of the iron tongues the instrument could be tuned. This *sansa*-type instrument was played mainly by young men (Krige 1982: 22).

The wooden clappers *mewasa* (Fig. 72) used by *vyali* girls also fall into this category of instruments made of inherently resonant materials.

Fig. 72. Wooden clappers, *mewasa*, used by girls during the *vyali* initiation, SAM–9858, Krige Collection, 1936–8.

Playthings

In making playthings, children acquired a lot of useful knowledge of the environment and an early training in craftwork. Herd-boys made everything they used in hunting and in playing games. They got to know the qualities of the different woods and their toys changed with the seasonal availability of the natural materials, grasses (see p. 89), fruit shells, or maize stalks. Wooden toys included wagons, motor cars, guns, sledges, and clubs for playing *khôrôrô*, a game similar to hockey (Krige & Krige 1943: 108). Today boys still make their own toys but the raw materials seldom come from the veld. Wire, bottle-caps and tin-cans are used most effectively for making cars, tractors or lorries.

Ritual objects, figures and carved poles

At present little is known about the traditions of figurative carving among the people of the northern Transvaal, although a thesis based on field research undertaken in the 1970s is in preparation (A. Nettleton, Department of Fine Art, University of the Witwatersrand, 1981 pers. comm.).

Carved figures of symbolic significance in initiation rituals are used by the Venda (Stayt 1931: pl. 31) and have also been collected among the Kgaga of Maake and the Narene of Sekôrôrô (Potchefstroom University Collection). A male and a female figure in the collection of J. Witt of Tzaneen were said to have been among the Lobedu *digôma* revealed to initiates during a *vyali* initiation (see p. 99). At the end of the *vyali* the costumes and all associated objects should be burnt, so it is unusual for them to be represented in museum or private collections. Furthermore, the secret nature of these objects forbids their description by those who have seen them. A *gôma* is essentially something

A

B

Fig. 73. A. Layout of huts around central *khôrô* of Modjadji's village, the capital, 1973. B. The *khôrô* surrounded by forked poles.

secret and mysterious but it may be intrinsically very simple. The ritual context of its revelation imbues a *gôma* with its awesome quality.

The wooden clappers, *mewasa* (Fig. 72), used by *vyali* girls to accompany their songs, are simply two flat pieces of wood carved to a point at one end and a handle at the other. No significance is attached to their manufacture but, once used, they acquire significance and they must be burnt at the end of the school.

For the *vyali* initiation a row of debarked poles is set up in the *khôrô* in a specially medicated furrow at the back of a carefully prepared platform, *levhalêlô la vyali*, on which the initiates stand when singing. In front of this is the *kholonôni* shrine, a circular mound of clay in which a river stone is embedded and in the centre of which is a forked, medicated pole of *musoso* wood (*Terminalia sericea*, vaalboom) believed to have protective powers (Krige & Krige 1943: 136).

The *khôrô* of the Queen's village (Fig. 73A) is surrounded by a palisade of pointed or forked poles (Fig. 73B) that may only be used in the villages of chiefs or headmen. Headmen from all the districts are called up to provide poles for the Queen's *khôrô* when it is renewed. In this way the *khôrô* of the capital expresses the solidarity of the chiefdom. The entrance to the *khôrô* is also the entrance to the village and, as such, it is protected with posts of special wood (*kherale* or *moludu*) treated with medicines when they were set up. Beneath the threshold a medicated wand or a river stone is buried to neutralize or 'cool' any evil that may threaten the village. These measures are but a very small part of a complex scheme for protection of the village.

Fig. 74. Carved *khôrô* poles at the capital, 1973.

Some of the *khôrô* poles are carved in the form of stylized figures (Figs 74, 75A–C). Their meaning is not fully understood. According to Krige (notes) they were made to honour the Queen. Schlosser (1975: 95) stated that they were exclusive to the Queen's *khôrô* but had no other significance. According to J. Witt of Tzaneen who has made a collection of carved poles from Modjadji's *khôrô*, craftsmen of particular skill carved the poles to distinguish their contribution to the *khôrô*.

Fig. 75. Carved *khôrô* poles. A–B. From the capital, now in private collection of J. Witt. C. Collected when the poles of the *khôrô* at the capital were being renewed, SAM–9751, Krige Collection, 1936–8.

Structures

Although the study of settlement pattern, hut forms and building-techniques was not a main focus in this study, structures and building-techniques recorded in the 1970s are briefly described and supplemented by data and photographs from the 1930s provided by E. J. Krige.

The smallest cluster of huts within a village consists of a sleeping-hut, *nḓô*, a cooking-hut, *khetaga*, and a courtyard, *mosha*, formed by the space between them. At the capital these pairs of huts are arranged in a circle round a central courtyard, the *khôrô* (Fig. 73A). Sleeping-huts all face the *khôrô* and cooking-huts have their backs to the *khôrô*. Each wife in a polygynous family has her own *mosha*, her own utensils, storage area, granaries, and fields. The household of the chief wife of the head of the village is usually positioned opposite the main entrance but, apart from this, there is no ranking of household units within the village. In smaller settlements there is no *khôrô* and huts are arranged in an arc or straight line.

Fig. 76. Framework of a hut under construction in the 1930s. Photo: E. J. Krige, 1936–8.

1. *Huts*

The oldest huts were built using the pole-and-daga method but even before the 1930s sun-dried mud-brick construction was replacing the older method that drew heavily on timber resources. Between 80 and 100 poles were needed for a single hut (Fig. 76). The following description of the pole-and-daga method was recorded in 1976 from wood-carver F. Semosa, and examples of the materials were collected for reconstructing a hut at the South African Museum. Hard, termite-resistant woods such as *moathaba* (*Pterocarpus rotundifolius*), *mosese* (*Peltophorum africanum*), or *morêjê* (*Dicrostachys cinerea*) were said to have been preferred, but many other hard woods were also used. It was often necessary to straighten the poles before use. This was done ingeniously by making a series of oblique cuts on the inner curve of the pole while it was still green and then wedging it in the fork of a tree and bending it straight (Fig. 77A). In 1976 poles straightened in this way were still visible in one of the oldest huts at the capital (Fig. 77B). The process, *-vhaga*, was also used by the Venda (Van Warmelo 1937: 299; Van der Waal 1977: 79) whose hut-building techniques were similar in many respects to those of the Lobedu.

The straightened poles were carved roughly to a point at one end and embedded in the ground to a depth of about 40–50 cm, following a circle that had been traced out on cleared ground. The soil was saturated with water to facilitate embedding the poles. Flexible withies from trees such as *mofwara tsweni* or *mothala maligana* (both *Grewia* spp.) encircled the poles horizontally at regular intervals and were lashed on to the framework with strong bark fibre. Both the laths and the bark had to be softened in water before use. The ridges formed by the laths were usually accentuated in the plastering-process and made into ledges in the walls. A mixture of mud and dung was applied by hand to the framework both inside and out. This part of the work was done by women and they also helped with transporting the materials from the bush and collected the thatching-grass for the roof (Frans Semosa 1976, field records).

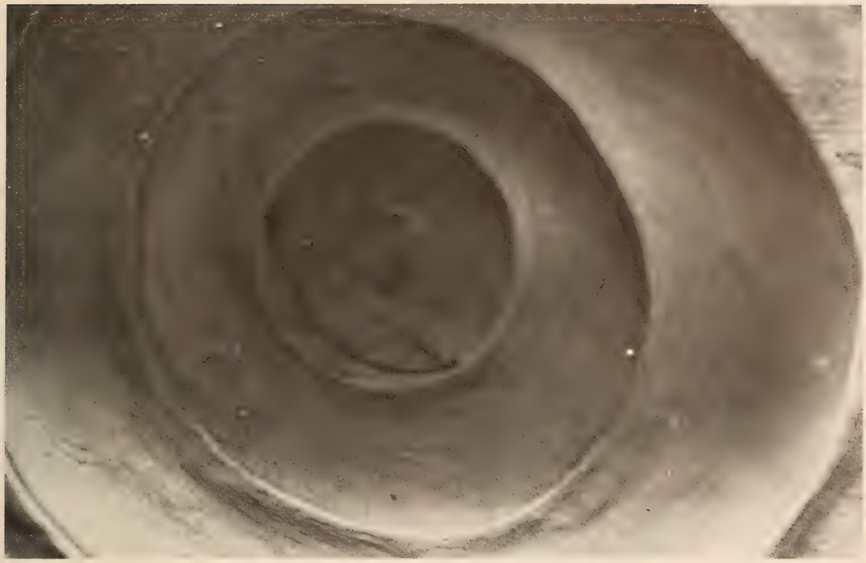
The conical roof structure of the oldest huts was made of closely packed rafters (Fig. 78B). To construct the roof a central post, *mosima*, was erected in the middle of the hut, and a working-platform was made by placing planks across the walls and securing them to the central post. The pointed wooden roof pinnacle, *lenoḓu*, was supported by the *mosima* while the rafters, *levhalêlô la thaga*, sharpened at the upper end, were tied to the pinnacle. The lower ends of the rafters rested on and were tied to the poles forming the walls, *levhalêlô la tshite*. Flexible cross-laths tied to the rafters encircled the roof at intervals. When the roof was complete the *mosima* was cut away (Krige 1982: 13).

The roof was thatched with bundles of grass placed on top of the rafters (see p. 93). Krige recorded that in the 1930s the plastering of some sleeping-huts continued up into the roof to form a plastered dome (Fig. 78A). 'This dome has circular rims marking the cross-laths which, beneath the plaster, hold together the framework of closely packed rafters' (Krige & Krige 1943: 21). This

A

B

Fig. 77. A. Straightening a pole by wedging it between two trees after oblique cuts have been made on the curve of the pole, Semosa's homestead, 1976. B. Hut poles showing the cuts, Modjadji's village, 1976.



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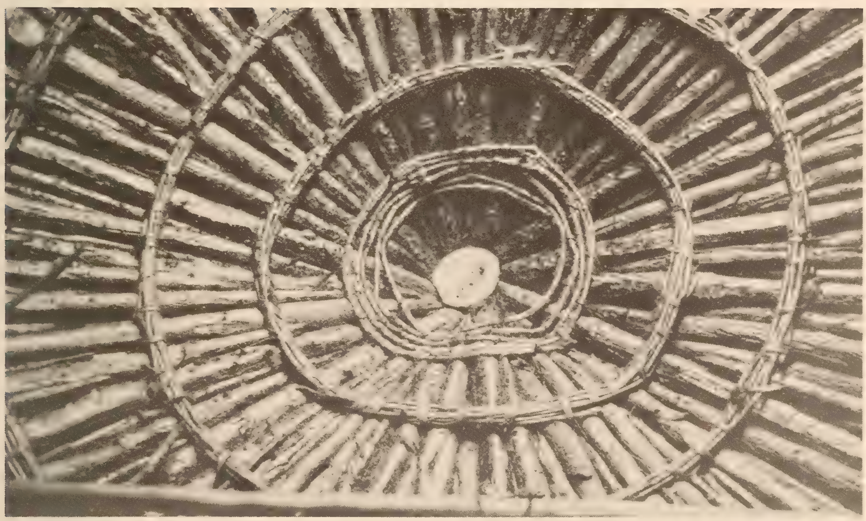


B

Fig. 78. A. Plastered roof of a sleeping-hut. Photo: E. J. Krige, 1936–8. B. Traditional roof structure of a cooking-hut. Closely packed rafters support the thatch. Modjadji's village, 1976.

feature, also found in Venda huts (Van der Waal 1977: 88), gave a very neat finish to the hut interior. These architectural details disappeared when new construction techniques were adopted. The plastered ridges were not made on mud-brick walls, and ceilings could not be plastered when widely spaced rafters were used (Fig. 79A).

Wooden doors used in sleeping-huts were carved from solid pieces of soft wood such as wild-fig and hinged by means of projections on the upper and lower ends that fitted into sockets in the lintel and threshold beams. A reed door (see p. 85 and Fig. 16) was used in the cooking-hut.

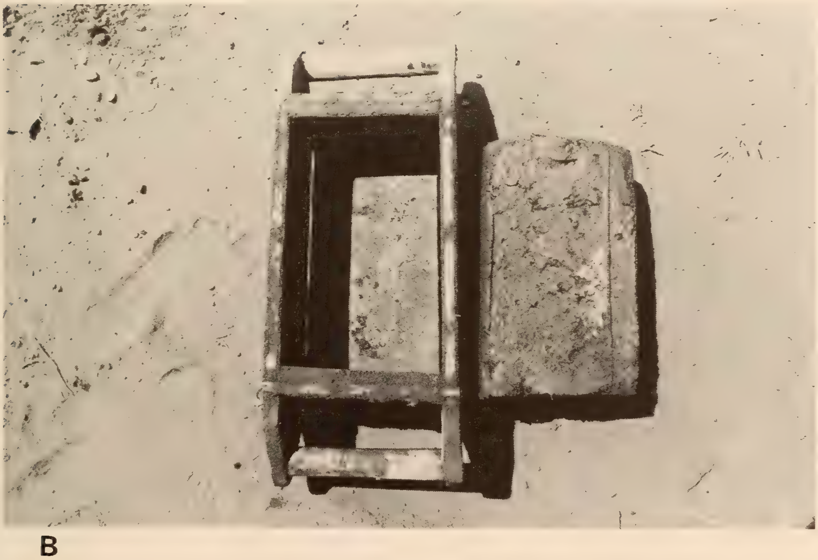
By the 1930s brick construction, which had been taught by the mission since the late nineteenth century, was replacing the older pole-and-daga construction method, and legislation to protect many of the indigenous trees accelerated the process by reducing the availability of wood (Krige 1941: 18). Bricks were made by women and men using wooden box moulds (Fig. 79B) or tins and at the capital bricks were commissioned for 10 shillings per 800–1 000 bricks (Krige 1941: 18). The increased participation by women in hut-building compensated to some extent for the absence of men working in towns, and building with sun-dried mud-bricks has continued to the present both for the conventional round huts described below and for more modern houses.

The ground is cleared and a circle drawn with a stick attached to a string fixed to a peg in the centre of the circle. A shallow trench of stones is usually laid as a foundation for the brick coursing. Mud plaster is applied between the bricks and, when the wall is complete, to the interior and exterior. The initial plastering is done by hand and a wooden tool, *khevhadô*, is used for compacting the plaster. The same tool is used at a later stage when the roof is complete for compacting the mud floors of huts and courtyards, which are smoothed, *-ridêla*, with a stone, *thidêlô*, then smeared with dung, and sometimes decorated with patterns made by running the fingers over the wet dung.

The traditional roof structure of closely packed rafters, which supported the thatching grass without the need for sewing, was replaced by the 'rondavel' roof of widely spaced rafters, usually of purchased blue-gum timber, on to which the thatch was sewn. In the 1930s modern window and door-frames were rare except at the Christian settlement, but by 1940 a few rectangular houses with windows had been built at the capital (Krige 1982 pers. comm.). Subsequently many rectangular-shaped huts with thatch or tin roofs were built but in the 1970s, at the capital and in smaller settlements, the circular-plan hut remained the most widely used dwelling.

In the 1970s the apparent trend among non-traditionalists who could afford the materials and were living within access to transport was toward modern housing. Many people, however, still lived long distances from main roads and the most frequently seen dwellings were mud-brick huts, which are low-cost structures appropriately designed for a hot climate and a living-pattern in which most activities take place out of doors.

A



B

Fig. 79. A. Modern 'rondavel' type roof structure with widely spaced rafters, plastered mud-brick walls. Modjadji's village, 1973. B. Mud-brick and mould, Ramatswalela's homestead, 1975.

2. *Granaries*

In the 1930s granaries were very much a part of Lobedu domestic life. Permanent granaries were built in the storage area, *marala*, behind the huts and temporary granaries were built in the fields at harvest season. By the late 1970s there was no need for granaries as there was not enough grain to be stored and most families depended on bought maize-meal for their basic subsistence requirements. Very few granaries were seen in use during fieldwork and the traditional grain pit for maize had fallen completely into disuse. The following descriptions are based on photographs and information recorded in the late 1930s by E. J. Krige (1982: 14–15).

Traditionally decobbed maize was stored for long periods in a grain pit, *kheledese* (Fig. 80), usually situated in the cattle kraal. At the royal village the pits were in the *khôrô*. The pit was a large hole in the ground lined with dung and grass; it had a fairly narrow opening but broadened out below ground level. Before being placed in the pit the grain had to be completely dry to minimize

Fig. 80. *Kheledese*, pit for storing maize. Note depth of earth above opening of pit. Photo: E. J. Krige, 1936–8.

A

B

Fig. 81. A. Disused *kheashô*, granary formerly used for storing maize on the cob. Near forest of cycads, 1976. B. *Kheashô* with grass interwoven between poles set further apart. Said to have been adopted from Tsonga-speakers. Photo: E. J. Krige, 1936–8.

the chances of it rotting. A stone was placed over the opening, which was then sealed with dung and covered with earth to ground level. A stone was placed to mark the stituation of the pit. Storage in the sealed pit changed the flavour of the maize, which was then called *madoni*. Certain pits were known to produce particularly good *madoni* and were used repeatedly.

The *kheashô* (Fig. 81A) was a structure of poles, *mabala*, encircled by cross-laths at the top, middle and base, and secured with bark fibre. The base was raised about 20 cm off the ground on forked posts or large stones. This was the traditional way of storing maize on the cob while drying. A similar structure, also referred to as *kheashô* (Fig. 81B), but with grass woven between the poles, was introduced by Tsonga immigrants. The grass was said to protect the grain from being pecked at by fowls. This protection was only necessary after the Tsonga practice of keeping fowls had gained acceptance among the Lobedu.

The *ledulu* (Fig. 82) was a granary of roughly the same shape as the

Fig. 82. *Ledulu* granary for millet and sorghum, made of a wooden framework plastered with clay. The thatched roof must be removed to reach the contents. Photo: E. J. Krige, 1936–8.

kheashô but the walls were plastered with daga and it had a conical thatched roof that had to be lifted to reach the contents. It could be sealed for long-term storage. The *ledulu* was the traditional Tsonga granary for decobbed mealies but was widely used by the Lobedu and the Venda for sorghum and millet as well as for the short-term storage of maize.

The *leṱole* (Fig. 83) was a temporary granary erected in the fields for storing sorghum before it was threshed. Structurally it was an inverted roof supported by forked upright posts. It was lined and covered with grass to protect the grain

Fig. 83. *Leṱôle* granary in which sorghum was stored in the fields before threshing. Photo: E. J. Krige, 1936–8.

from birds. A raised platform *moakô* (Fig. 84), was also used in the fields for temporary storage of millet and sorghum prior to threshing and winnowing. In spring these platforms were used to stand on when scaring birds from crops. A smaller permanent platform, *vhoalô*, built inside the cooking-hut, was used for keeping bags of grain off the ground to protect them from termites and other insects. In the 1970s these platforms were still seen in some traditional households.

STONE

Oral traditions record a time in Lobedu history (probably in the late eighteenth century) when stone enclosures were built. The description (Krige & Krige 1943: 7) of high stone walls, upright stone projections, and a stone seat for the chief clearly link the Lobedu with the Venda and their Karanga ancestors

Fig. 84. *Moakô* platform used for temporary storage of sorghum in the fields prior to threshing. Photo: E. J. Krige, 1936–8.

north of the Limpopo River. The ruins of these stone structures associated with the reign of Chief Kheale are still standing, although much overgrown. The site is strategically situated on a hill-top commanding a good view of the surrounding country. In other areas there are remains of stone-walled enclosures for livestock and terraces of former occupation sites (Fig. 85).

In some villages stone-walled enclosures for livestock are still found and stone is still used for the contour walling on the cultivated hillslopes. Many old contour walls, *maraka*, are now overgrown but they show up well on aerial photographs. Valley cultivation was at first practised only by Tsonga-speaking immigrants but later shortage of arable land on the hillsides and the introduction of an effective plough led increasing numbers of Lobedu to cultivate the flatter ground. The plough, however, destroyed the protective verges of the fields and broke down many of the stone contour walls that prevented erosion (Krige & Krige 1943: 236). Where cultivation of the steep hillslopes has continued, stone contour walling is still built.

Unworked stones were and still are used in a number of ways for grinding, crushing, pounding, or smoothing. In a pair of grinding-stones, the lower stone, *lwala*, is usually flat, large and fairly rough while the upper stone is smaller, harder and rounded. Stones are used for grinding sorghum and millet but not for maize, which is stamped in a mortar. Heads of maize are decobbed on a rough stone (Fig. 86). During the preparation of clay it is pounded with a wooden pestle on a large grinding-stone. Smaller, hard stones are used for cracking open the hard shells of marula pits and generally for cracking nuts. A hard, smooth

Fig. 85. Much overgrown stone-walled enclosure, near Modjadji's Nek, 1973.

Fig. 86. Rough stone for removing maize from the cob. Molototsi valley, 1975.

stone, *thidêlô*, is used to compact the surface of a newly made mud floor and smaller rounded river stones are the traditional smoothers and burnishing-tools for pottery (see p. 56).

Sandstone, *lehutô*, often referred to as the 'Vim' stone, is widely used as an abrasive cleaning agent for utensils. A large grinding-stone on which the *lehutô*

is crushed is generally found near the washing-up area (Fig. 87). A less abrasive stone is used for scrubbing the body when washing.

Herd-boys in the fields used hollow stones as troughs for goat's milk which they curdled by adding acidic fruit juice and ate with spoons made from grass or leaves (Krige & Krige 1943: 107).

Fig. 87. Grinding-stones for crushing sandstone into an abrasive powder for scouring utensils. Note pot for water, calabash utensils, and spoon. Modjadji's village, 1975.

Stone-carving seems to have been confined to the making of soapstone (steatite) pipe-bowls, *gagana* (Fig. 88), for smoking dagga, *badje* (*Cannabis sativa*). No technical information was obtained on their manufacture and they are no longer made. According to Krige (1982: 41) they were used together with a reed, *kheṭomêla*, and a horn water-vessel, *naga la khomo*. The dagga was placed in the stone bowl fitted over one end of the reed, the other end was inserted in the horn filled with water. A glowing ember was placed in the bowl on top of the dagga and the smoker drew the smoke through the water by inhaling deeply over the mouth of the horn. This provoked a strong flow of tears and saliva which could be expelled through another reed, *mphasi*. This was called *maada a khoho*.

By the 1930s dagga-smoking was illegal and the horn water-pipe was no longer in use. To avoid being arrested people had taken to placing the dagga in a dampened hole in the ground, and smoking in a lying position. The smoker filled his mouth with water and drew the smoke from the dagga through a reed,

Fig. 88. Stone pipe-bowls, K68, Klapwijk Collection.

khetomêla, positioned to make contact with the dagga which had been placed in the hole and lit. Nowadays dagga is not smoked through water but in an ordinary pipe or by rolling it in paper.

SUMMARY AND COMMENT

The indigenous Lowveld environment offered a wide range of materials for possible exploitation. In the above section the uses of clay, grass and other plant fibres, wood, and stone are described. Although many of the techniques are termed 'traditional' this is not intended to imply a fixed body of skills but to refer to processes that had developed and continued to develop in a particular environment and within a self-sufficient subsistence economy.

The form of the material culture at any one time depends on an interaction of technical, economic, social, and ideological factors, each of which contains a number of related variables. Technical variables include the types of material, the tools and the skills; economic variables include the demand for the products, the division of labour, and the impact of money and mercantile goods on local production; social variables encompass the range of social contexts for the use of artefacts and customary patterns of use; ideological variables relate to the system of values that gives meaning to certain materials and products.

Natural resources constituted the most important material base in the Lobedu economy. In addition to providing wild foods and land for cultivation and grazing, the natural environment provided most of the materials on which the productive technology depended for the construction of settlements and the

satisfaction of most other material requirements. Using the Krige Collection as a sample, over 60 per cent of the inventory of artefacts derive primarily from the indigenous environment and, if huts and granaries were included, the figure would be well over 80 per cent.

Knowledge of the natural environment was a very significant aspect of technology. In the 1930s Krige & Krige (1943: 45–50) recorded the names of over 500 plants used as food and in the technology, and commented that knowledge of the vegetation and its application in craftwork amounted to a 'veritable science'. Selection of appropriate materials for particular purposes was an essential part of the technical process. This knowledge was acquired from an early age in play activities and later through participation in subsistence activities. Herd-boys, for example, developed a sensitive understanding of their environment and acquired many technical skills. Since children have been receiving formal education in school, less time is spent in the veld and less is learnt about the natural environment. School education has also tended to undermine a value system that stressed order in nature and the ritual control of nature by the chief through the ancestors.

Lobedu orientation toward nature was expressed not only tangibly in the material culture but intangibly in the rain and fertility cult, and the seasonal ritual offering of the first termites to the 'rain-pots'. In the *vuhwera* and *vyali* initiation rituals there was a strong emphasis on the wearing of costumes from the appropriate natural materials, often associated with rain and damp places and believed to have positive 'cooling' qualities. In the *vuhwera* costumes there was an integration of tangible materials and the intangible symbolic values with which they were invested. These values were further echoed in the songs of accompanying *vyali* girls which were believed to enhance fertility.

Human use of natural resources modifies the environment which, in fact, becomes partly man-made. The clearing of land for settlement and cultivation depletes the natural resources and, in the area under study, the accessibility of many of the traditionally used plant fibres and woods has been appreciably reduced. Depletion of timber resources prior to the 1930s and consequent legal restrictions on the felling of trees encouraged a change in the method of roofing from closely packed to widely spaced rafters, and of hut-building from pole-and-daga construction to that of mud-bricks. The latter change in building technology, which involved a greater use of mud, was also encouraged by an increased participation of women in hut-building to compensate for the absence of men working in towns.

Sources of clay, mainly in river-banks, are distributed throughout the area and in the 1970s were still used extensively by potters. A number of factors have contributed toward continuity of the craft of pottery. Important among these is the fact that women are the potters and main users of the products. The technology has been passed on from one generation of women to the next, women have tended to remain in the rural villages, and the pattern of use has remained relatively constant. Earthenware is generally preferred for cooking on an

open hearth and clay pots are less expensive than cast-iron alternatives. Although water may be carried in lighter tin or plastic containers, it is always stored in earthenware, which has the practical advantage of keeping water cool and fresh.

Since the 1930s when only a few of the Christian community made a 'business of pottery' (Krige & Krige 1943: 320), the manufacture of pottery for sale has increased. Pottery not only supplies subsistence needs but is one of the ways in which village women can earn money without having to seek wage employment. This factor has led to an increase in the scale of production.

Although the staple diet has remained maize-based, there is a qualitative nutritional difference between home-stamped maize-meal and the less nutritious refined product bought in the shops. Most people, however, are dependent on bought maize as over-population has resulted in many people being landless. The insufficiency of grain is reflected in the disuse of granaries, a reduction in the frequency of stamping maize and in the decreased use of related utensils such as mortars, mats for drying meal and pots for steeping grain prior to stamping.

Changes in basketry since the 1930s seem to relate mainly to reduced demand for certain products as a result of the changing subsistence base, an increase of migrant labour, and related changes of values. An example of this is the *kherodwana* basket that has become almost obsolete following a change in the pattern of marriage as a result of migrancy. Formerly this serving-basket was symbolic of the willingness of a bride to honour her husband and to serve him respectfully. As migrancy increased many marriages were contracted in the absence of the man with the result that there was little need for the basket. The wooden porridge dish, *delô*, which fitted inside the basket was also used less frequently. As demand decreased, so did the motivation to transmit the related technical skills, with the result that they are unknown to the younger generation.

The replacement of woven beer-strainers by a large wooden sieve was related to the brewing of maize-meal beer for sale. Formerly woven strainers were used when beer was brewed in relatively small quantities, mainly from sorghum, and was used to fulfil social obligations or to show hospitality. This type of strainer was not suited to straining large volumes nor was it suitable for beer made from maize-meal. On the other hand, the fine-meshed, wooden-framed sieve is well suited to straining finely ground maize-meal and can handle large volumes. As beer-making for sale increased, the woven beer-strainer fell into disuse.

As migrancy increased, women took over the making of *moṱhaṱha* baskets and *paṱe* mats, traditionally made by men, and they continue to be made by women for domestic use, although the *moṱhaṱha* baskets have largely been replaced by enamelware.

Working with wood, including the weaving of baskets from wood-slivers, remains exclusive to men and has tended to become more specialized. Many

new tools have been added to the tool-kit but the traditional adzes and gouges, well adapted to their functions, have not been replaced. Tool marks made by a *lehôrô* gouge are visible on a number of items in the Krige Collection and this type of tool was still used by woodworkers in the 1970s. In general there is a visible relationship between the tools, the motor action of the user, and the form of the product. A change in the use of tools is usually detectable on the artefact and this is particularly so when modern knives, files, and sandpaper are used.

Traditionally many natural materials were used without modification by formal tools. Stones, selected for their particular shape or texture, were used as nut-crackers, grinders, and smoothers. The abrasive *lehutô* was and still is widely used for scouring utensils, and the 'loofah' plant, *leshokhotô* (*Luffa aegyptiaca*) provides an effective scourer. Many plant fibres can be used as lashings without any technical preparation and the natural shape of the *Bauhinia* seed-pod, *thema*, is well suited to its use as a pottery tool. Thus natural materials continue to be used in a variety of ways and have not been replaced by purchased alternatives.

Despite the transition to a money economy, in many respects the natural environment remains an important, if diminishing, source of materials and, where there is still a demand for traditional products, the related technical skills remain alive.

USE OF DOMESTIC RESOURCES

The products of cultivation and livestock husbandry form the main content of this section but fruit shells, although natural resources, are included with gourds, and horns of game animals with those of cattle, as technically they are treated in similar ways.

GOURDS

Gourds belong to the family Cucurbitaceae, as do pumpkins and melons. They are cultivated for their fruits and for their leaves which are made into a relish. The mature fruits of the indigenous species *Lagenaria siceraria* (formerly *Lagenaria vulgaria*) are widely used for making calabash utensils. The smooth-skinned gourd, *thaga*, grows in a variety of shapes that lend themselves well to the making of ladles, scoops and flasks; the small rough-skinned gourd, *leraka*, is used mainly for making rattles. The seeds from gourds of useful shape are kept for the following season.

Seeds are sown during the summer rains between November and January. Most women plant gourds among the other crops and leave them in the fields until they are the required size and hardness. By June the mature gourds are usually considered 'strong enough' to be picked and made into utensils. There is no specialization in this activity—all the village women know how to prepare calabashes and make those that are needed for domestic use. Some women are

expert at cutting a neat rim and are asked to do this for others. If a woman has made too many calabashes for her own use she may exchange them for produce or sell them.

Gourd-working techniques

A gourd of suitable shape is selected for the product in mind. The method of manufacture is essentially the same for all calabash vessels. The process observed during fieldwork in the 1970s did not differ from that described by Krige for the 1930s. A small hole is cut in the gourd which is then cooked in boiling water for about an hour. When cool, the hole is enlarged, the soft inner flesh removed with a spoon (formerly with a seed-pod scraper, *thema*) and the edge of

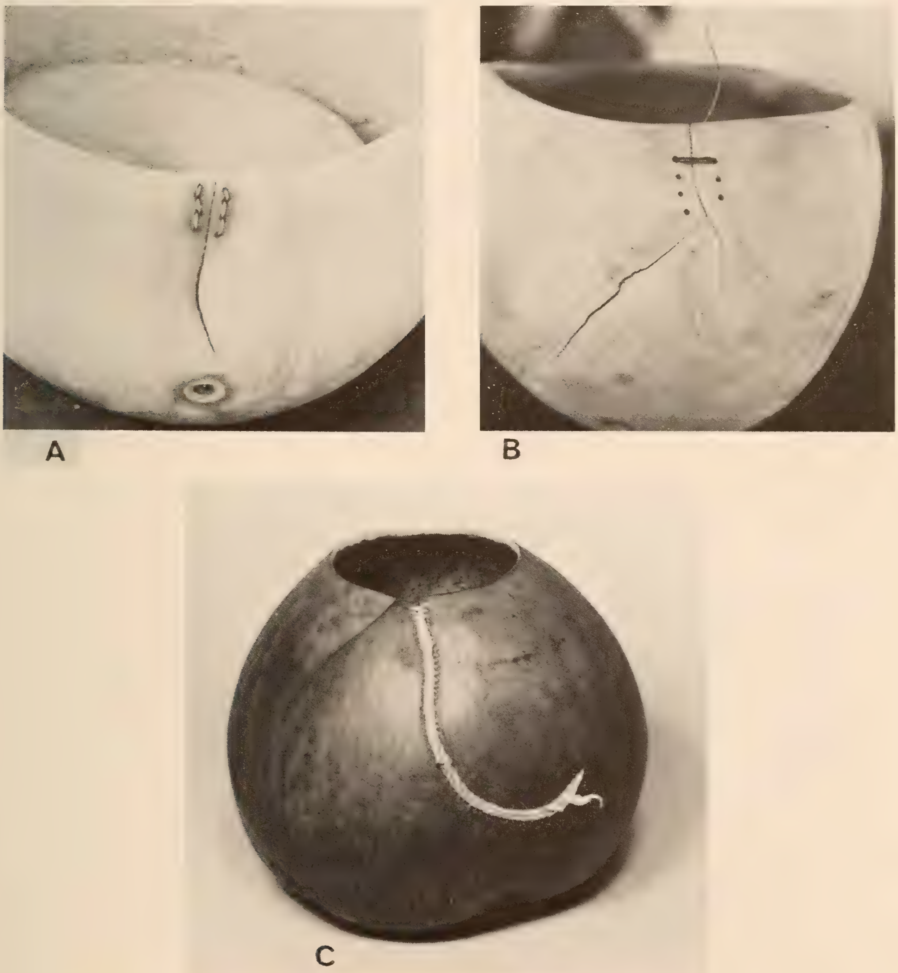


Fig. 89. Repair techniques for calabash utensils. A–B. With wire. C. With string.

the rim cut neatly with a knife. The outer skin is scraped off, *-thala*, and the gourd is then scoured, *-huta*, inside and out with powdered sandstone, *lehutô*. It is left outside to dry and is then ready for use. Constant washing with *lehutô* removes any rough edges from the rim and gives the calabash a smooth finish. In this way the quality of a calabash utensil improves with use.

The method of preparation differs slightly if the gourd used is too big to fit into a pot of boiling water. After the hole has been cut, the gourd is inverted and left for about a week so that the flesh can rot. Thereafter the inside is cleaned out, the outer skin scraped off, and the surface scoured.

Rattles are made simply by letting a *leraka* gourd dry out thoroughly. It is not boiled. Holes are branded at opposite ends and the inside is cleaned out with a twig. Small stones or seeds are put into the cavity and a stick longer than the gourd is pushed through so that it stops the holes and forms a handle at one end.

Cracked or broken calabashes may be repaired by making a row of tiny holes on either side of the crack with a fine awl made from a sharpened nail or umbrella-spoke. The crack is then sewn together with fibre string or fine wire (Fig. 89A–C). The stitch may be simple oversewing or a more complicated stitch such as herring-bone. During the months when gourds for making new calabashes are not available, repairs become a practical necessity.

Fig. 90. Calabash utensils: bowl, *khethêba*, SAM–9686; scoop, *khefhahô*, SAM–9711; and ladle, *khehô*, SAM–9693. (All Krige Collection, 1936–8.)

Uses of gourds

Utensils and containers

Gourds are made into a number of domestic utensils including bowls, ladles, scoops and flasks (Fig. 90). A calabash bowl, *khethêba*, is in daily use for the staple maize-meal porridge, *vhoswa*. A smaller *khethêbana* is used for soft porridge, *khepye*, and for serving beer individually to an honoured guest. When used for beer it is referred to as *phafhana*.

Ladles, *zwihô*, of various shapes are in regular use. *Khehô kha vyalwa* is a long-handled ladle for serving and drinking beer. The long handle makes it easy to pass from one person to another. *Khehô kha mabudu* is a short-handled ladle for light beer not usually drunk in company. *Khehô kha meezi* is a large ladle for transferring water from a storage pot to other containers.

An open scoop, *khefhahô*, is used for handling dry meal. When making porridge the meal is added to the water with this utensil.

A large vessel, *mokhaba* (Fig. 91A), is used for transporting liquids. The small mouth prevents spillage and it is much lighter and less likely to break than a clay vessel used for the same purpose. In the 1930s a waisted calabash, *khekhôbô* (Fig. 91B), was in use as a portable flask for carrying thin porridge. Seeds or dried beans were kept in similar calabash vessels. Modern containers have largely replaced calabashes for these functions.

Small-waisted calabashes fitted with stoppers were used as containers for herbs, medicines, or snuff (Fig. 92). To some extent these have been replaced by small tins and bottles but they are still used, especially for medicines.

Musical instruments

The resonators of certain musical bows and xylophones consist of suitably shaped calabashes. The musical bow, *khekhaba*, (see p. 124) which derives its name from the North Sotho word for a gourd, has a single calabash resonator that is held against the player's body during performance. A xylophone, *bela*, (see p. 129) has a resonator below each wooden bar. They are oval in shape, graded and positioned so that the largest calabash is the resonator for the deepest note. Near the closed end of each resonator there is a small hole with resin on the rim and covered with pieces of spider's web which vibrate when the instrument is played and add to its tone (Kirby 1934: 50–56). Xylophone players kept the seeds of successful resonator gourds so that they could cultivate gourds of similar shape.

Rattles, *tshêlê* (Fig. 93A), used in rituals of spirit possession are made from the rough-skinned gourd, *leraka*, in the manner described above (p. 152). Leg rattles, *mathodzi* (Fig. 93B), are made from the smooth hard-shelled fruit of the *mothodzi* tree (*Oncoba spinosa*). When the *lethodzi* fruit has turned a dark brown on the tree it is picked, a small hole is made at each end and the seeds removed with a stick. Small stones are put inside the dry empty shells and a stick is passed through the holes to close them. Three or four sticks each fitted with

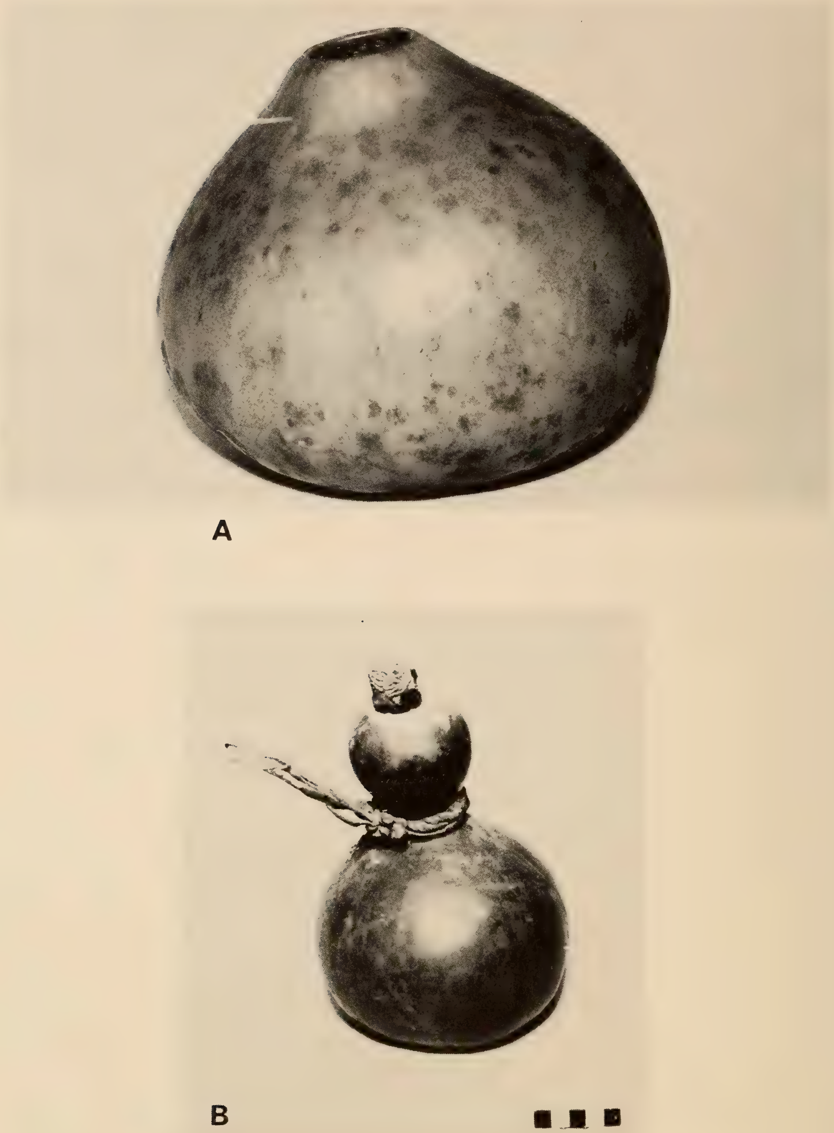


Fig. 91. A. Calabash flask, *mokhaba*, SAM–9732. B. Waisted flask, *khekhôbô*, SAM–9847. (Both Krige Collection, 1936–8.)

Fig. 92. Small calabash vessels for snuff or medicines, SAM–9918 and 9855. (Both Krige Collection, 1936–8.)

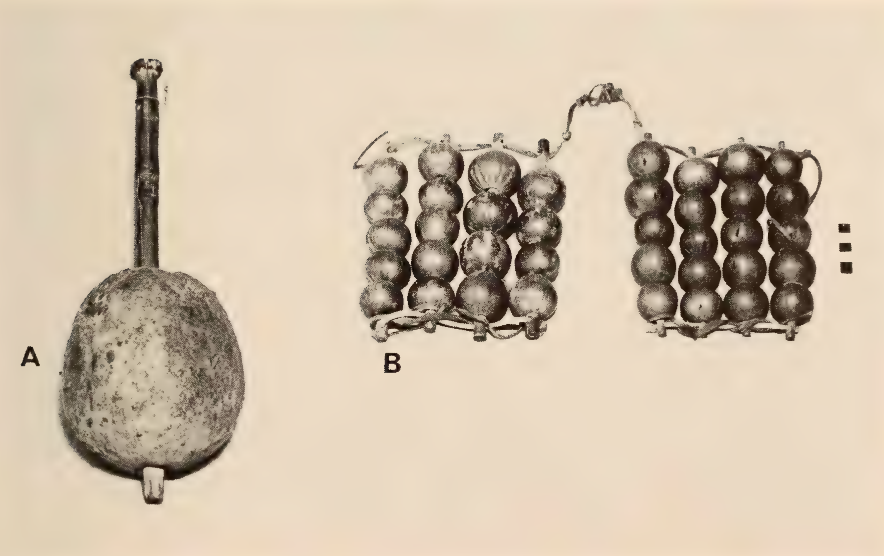


Fig. 93. Rattles. A. *Tshêlê* SAM–9830. B. *Mathodzi* SAM–9831. (Both Krige Collection, 1936–8.)

four or five fruit shells are held together with thongs, or sisal string, threaded through holes at the ends of the sticks. The thongs are long enough to be used to tie the rattles to the wearer's leg. Sometimes slits are made in the shells to enhance their sound. They are worn by *malôbô* dancers during spirit-possession rituals and at recreational dances.

Playthings

Young boys make humming-tops, *mankônyana*, out of *lethodzi* fruit shells. A stick is fitted into a hole at one end of the shell and fixed with beeswax. The string is wound round the stick and when pulled it causes the top to spin with a humming sound. According to Krige (notes) this is one of the oldest Lobedu toys. They were seen occasionally during the author's fieldwork.

Ritual uses

Melons, *maguadzi* (*Citrullus lanatus*), were among the first green foods each year to be ritually 'bitten' and offered to the 'rain-pots' (Krige & Krige 1943: 274). A small calabash, *phafhana*, was considered the most appropriate vessel in which to offer beer to the ancestors.

In former times a doll with a body made of a calabash was given to a girl when she reached puberty. This doll was kept by the girl until her marriage when it was carried in a *kherodwana* basket by the bridal party. If she were not a virgin the calabash was pierced. According to Krige & Krige (1943: 113) this custom had fallen into disuse by the 1930s.

SKINS AND HIDES

Livestock husbandry was less important in the Lobedu subsistence economy than agriculture and this is reflected in the material culture. Goatskins, however, were important in the traditional technology providing the main material for clothing as well as for the bellows used in metal-working. Goats were slaughtered on occasions of ritual or social importance and they were also used for the payment of debts or fines and in many other economic exchanges (Krige & Krige 1943: 45). Cattle, on the other hand, were rarely sacrificed and the use of their hides was less significant in the technology.

Skin-working techniques

Skin-working involved a number of processes: flaying the animal, fleshing, dressing, cutting, and sewing. Men did most of the work but women helped with the dressing of the skin (Fig. 94). The following description is based on accounts by men who no longer prepared skins in the 1970s but remembered the technology.

A skin was removed from the carcass, pegged out with wooden pegs, *dinôdô*, and rubbed with an abrasive stone or dry maize cob to scrape away the

Fig. 94. Woman applying fat to a goatskin. Photo: E. J. Krige 1936–8.

fat and clean the flesh side (Fig. 95). This removed matter that would putrify rapidly if the skin were left untreated. Thereafter it could be allowed to dry out before being softened or dressed. At this stage the skin was still very susceptible to infestation by insects or bacteria and the experienced skin-worker knew the value of certain plant oils and repellents that could be used to protect the raw hide (Krige & Krige 1943: 47). The dressing-process that followed rendered the skin less prone to decay but did not make it completely stable under unfavourable conditions.

The pelt was dampened with warm water for the softening-process, *-suha*, which was done by rubbing the skin briskly by hand. This was an arduous process and a number of men would work together on a single skin or take turns in

Fig. 95. Goatskin drying after the flesh side had been cleaned, Molototsi valley, 1976.

working on the skin. Pips of the *ditshidi* fruit (*Ximenia caffra*) were ground between two stones to extract the fat, which was then applied to the skin. This acted as a dressing and kept the skin supple. The hair was usually left on goatskins but could be removed before softening by soaking the skin in water and scraping the skin with a rough stone. Cattle-hides used for sandals, shields, and quivers were not softened but covered with dung and buried so that the hair would rot and fall off.

For certain purposes a prepared skin had to be cut and sewn to a conventional pattern. This was the work of a specialist craftsman. A woman's skirt, *motshe* (Fig. 96), required particular skill. Gussets were cut to give the skirt the correct shape; flaps of skin, *dinyedi*, were cut and sewn on later for decoration; a triangular 'tail' was cut and sewn on to the waist so that the hairy side faced outward when folded over the back of the skirt. Pieces of skin were formed into small studs and attached so that the hair showed up against the flesh side on which a nap was raised by making small incisions with a special metal tool, *mosêdô* (see p. 177), with a cutting edge that could be sharpened. The nap-raising process, *-ḓôga*, gave the skirt its characteristic texture and without this finish a skirt was not considered complete. Sewing the pieces together was done by passing sinew through holes made with a small awl. Ties at the waist of the skirt were traditionally made of plaited wild-cotton thread (*letshida*) and later of cotton thread bought from traders.

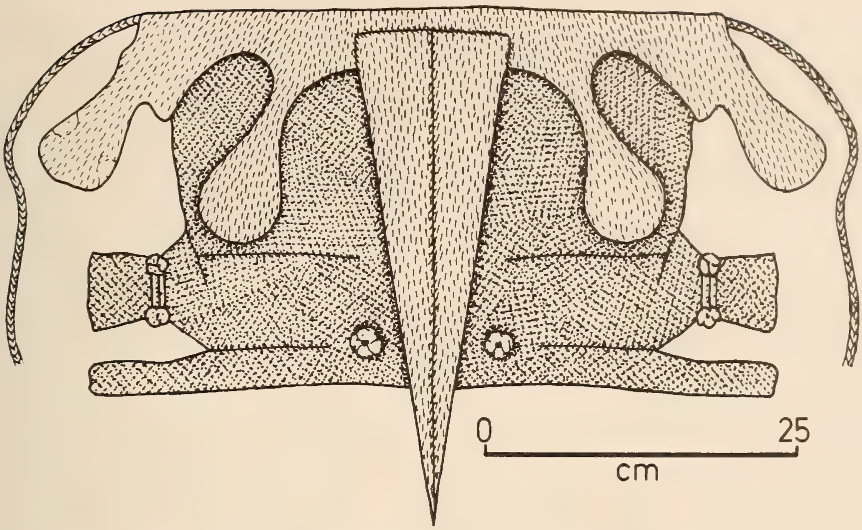


Fig. 96. Skirt, *motshe*, for a married woman, SAM–9762, Krige Collection, 1936–8.

A number of factors led to a decrease in demand for skin products and a decline in skin-working technology. The early adoption of European dress by migrants, the influence of the mission, and the popularity of cloth meant that fewer people wished to wear skin clothing and fewer men learnt the traditional skills. Many young men left the rural villages to work in town and the money they brought back to the villages had a compounding effect on the decline of skin-working by replacing goats in many traditional transactions and thus reducing the supply of skins (J. D. Krige 1934: 137, 145; Krige 1941: 17).

Uses of skins and hides

Clothing

Traditionally men wore a loin-covering, *thsête*, which was a triangular piece of goatskin that passed between the legs, and strings from the three ends were fastened in a knot at the back of the waist. A second piece of skin, called *bokône*, was attached to the waist-string to cover the buttocks. No other clothing was worn except a goatskin cloak in winter. In the 1930s it was very rare for men to wear skin clothing although it was not uncommon for a skin loin-covering to be worn under a pair of trousers (Krige 1982: 29).

Women's clothing consisted of a small triangular front apron, *thethô*, and a back apron, *thebyana* (worn mainly by unmarried girls), or a skirt, *motshe*, worn by married women and by unmarried girls (Fig. 97). A girl initiate coming out of seclusion at puberty was given a front apron, a back apron, and a skin cape to wear over the shoulders. A photograph taken in the 1930s (Krige & Krige 1943,

Fig. 97. Young girls wearing skin skirts and waist ornaments. Also note ear ornaments and hair-styles. Photo: E. J. Krige, 1936–8.

pl. 8a) shows that the hairy side of the skin was worn toward the body and the other side has a raised nap similar to that found on the *motshe*.

Skin aprons were important in the traditional exchanges that preceded a marriage. Among the gifts from the boy's to the girl's family was a goat, *pudi ya kebolao*, that provided the skin for the groom to prepare a *thebyana* for his future wife. This and a *thethô*, also prepared by the groom, was worn until after the birth of her first child. Thereafter the *thebyana* was replaced by a *motshe*. These skin aprons were more than simple items of clothing, they expressed materially the relationship between the two families. Thus 'People not only create their material culture and attach themselves to it, but also build up their relationships through it and see them in terms of it' (Evans-Pritchard 1940: 89).

By the 1930s cash payments had replaced many of the traditional gifts (J. D. Krige 1934: 137). Payments of money were explained in terms of 'thanking' the girl's parents for consenting to the marriage. In many cases the groom was working in town and absent from his village at the time when the preliminary arrangements for his marriage were being undertaken.

The production of skin clothing steadily declined. Imported cotton cloths such as salempore and morina had been introduced by traders in the area from the mid-nineteenth century onward and, together with mission influence and

changing economic conditions which encouraged migrancy, led to the eventual replacement of skin clothing by cloth wraps for women, and trousers and shirts for men. In the 1970s salempore and morina cloths were still worn by conservative women. Small skin aprons were retained by old women as under-garments but most young women wore modern dresses in keeping with their modern lifestyle. Skin clothing for general use was something of the past but the tradition was preserved to some extent in initiation schools. Skin skirts were also worn as special costume for dances or celebrations.

Hide sandals, *zwiêta zwamphashane*, were rare in the 1930s and today they are not made at all. A piece of hard hide was cut to the size of the foot and strips of skin were passed through slits in the sole at the toe and at the heel to fasten the sandal to the foot.

Sandals made of rubber from motor-car tyres were popular in the 1930s and were said to be durable and more comfortable than hide sandals. In the 1970s these sandals were still made and worn fairly widely.

Baby-slings

A skin sling, *thari*, was used for carrying a baby on the back (Fig. 98). Traditionally the skin used for making a *thari* came from the goat that a husband slaughtered in honour of the new-born baby. The skin was dressed in the manner described above and no cutting was needed. A nap was raised on the flesh side using the metal tool, *mosêdô*. The hairy side was worn on the inside against the body and a flap was folded over on to the side with the raised nap. To this flap various things might be attached. A *thari* collected in the 1930s has attached to it a soft fibrous bulb, *leôme*, which was used to wipe the baby's nose, a small skin bag of protective medicines, and strings of coloured glass beads, which expressed the mother's joy in her child. Most of the skin baby-slings seen in use in the 1970s had been handed down from previous generations but they were occasionally still made when a child was born. Most women, however, used blankets for carrying their babies.

Bags and pouches

Bags for general use and for special purposes were made of skin. A reptile-skin pouch, *khesigo*, was used to keep divining-bones when not in use. Medicines were often carried in small skin bags, *dithêvhêlê*, which could be attached to a girdle or baby-sling. Large skin bags used by men served the purpose of pockets before trousers were widely adopted (Krige 1982: 30). A set of reed pipes was kept in a skin bag made specially for this purpose.

Traditionally snuff was kept rolled up in a piece of soft goatskin, *moseâha* (Fig. 99), or in a calabash snuff-container (see p. 153) carried in a small pouch made of dassie skin. Horn snuff-boxes (see p. 167) were introduced by Tsonga-speakers and in the 1930s were widely used by Lobedu men (Krige notes). Small tins and bottles were and still are used as snuff containers. In the 1960s a piece

Fig. 98. Young girl carrying a baby in a *thari*. Photo: E. J. Krige, 1936–8.

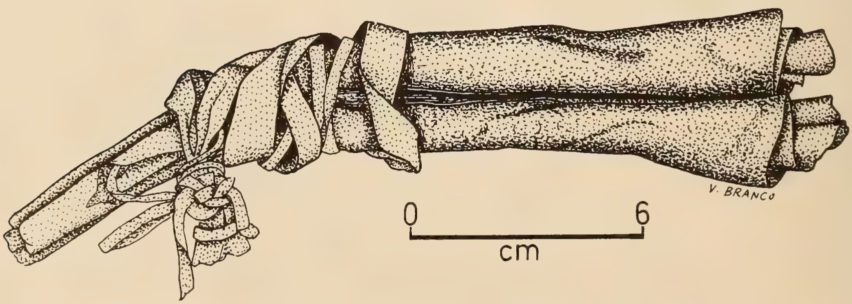


Fig. 99. Roll of skin for holding snuff, *mosêha*, SAM–9854, Krige Collection, 1936–8.

of plastic sheeting rolled up in the manner of the *mosêha* was a popular way of carrying snuff (Krige 1982 pers. comm.).

Poisoned arrow heads were kept in a hide quiver, *khôḓôbô*, and sharp knives were kept in a hide sheath, *khelada*.

Shields

An ox-hide shield, *khetagu*, was described by an old Lobedu man as being roughly of hour-glass shape with the narrow section at the grip. No specific information on making shields was obtained and no examples were seen in the field or in museum collections.

Skin components of weapons

A sleeve of tail skin from an ox or cow was used for the attachment of a spear-head to the shaft (see Fig. 112C). The wet skin was pulled over the join between head and shaft and when dry it formed a tight band that secured the attachment.

The string of a bow was made of a strip of twisted hide (see p. 115).

Thongs

Thongs or riems, *mazwa*, were used mainly for tethering animals and for inspanning cattle, a practice adopted from white farmers. They were also used generally for purposes that needed a strong binding-material. They are still made when suitable hide is available.

To make a riem, an ox-hide is put into water to soak and when thoroughly wet is put flat on the ground and cut round and round to give a very long strip of hide. The strip is thrown over a strong branch or a frame and a heavy stone is tied to the ends to weight them. In the 1930s bored stones were used for this purpose (Krige 1982: 31). Using a long stick, the thong is wound up tightly and then allowed to unwind. This is repeated a number of times while the skin dries out. The friction causes most of the hair to fall off and fat is applied to help preserve the skin and prevent the thong from becoming brittle.

This method of making thongs is widespread throughout southern Africa.

Other uses of skins and hides

Bellows

Goatskin bellows were used for forcing air into the furnace or forge during the smelting and smithing process. The two 'bags' of the bellows were made from the uncut skin of the hind legs of a goat (Krige 1982: 31).

Drums

Cow-hide was used for the heads of *gôma* and *thithimedzhô* drums and goatskin for the tambourine, *khethadada* (see p. 123).

Mats

Unworked but cleaned goatskins were used by some as sitting-mats. They were not as common as grass mats (Krige 1982: 31).

HORN AND BONE

The care of livestock was predominantly a male activity as was work on horns and hides. No specialized skill was required to convert horns into containers of various kinds and most horn artefacts utilize the natural form of the horn without any additional working. No artefacts were carved entirely from solid horn. Horn snuff-boxes were made by using both the solid end-section and the natural hollow of the horn.

Bone was not used to a large extent and when it was used the natural shape of the bone, or piece of bone, was modified to suit the particular function. Solid bone was not used as a carving medium.

Uses of horn and bone

Medical equipment

1. *Cupping-horn*

A cupping-horn, *moṱhoho* (Fig. 100A), consists of a small horn or end-section of a larger horn perforated at the solid tip so that it is open at both ends. Beeswax (*modu*) is used to seal the narrow opening during the cupping-process.

Cupping or blood-letting, *-lomêha*, is practised to cure headaches or pains believed to be caused by impure blood. Most people know how to use a cupping-horn and the operation does not have to be carried out by a diviner. Two small incisions are made in the affected area over which the wide end of the horn is placed. Air is sucked through the narrow end and blood is drawn into the horn by the vacuum. The tip is sealed with wax and blood continues to flow into the horn until the operator breaks the vacuum and removes the horn. The blood is buried in a secret place for fear of it being used in witchcraft.

2. *Medicine-horns*

Herbalists store medicines in ox-horns (Fig. 100B). Rain-water for use in special rituals is also kept in horn vessels. Horns used in this manner are not carved but many have holes drilled near the rim for the attachment of a thong.

3. *Divining-bones*

A set of Lobedu divining-bones consists of about forty pieces, the most important of which are the four flat carved bone or ivory pieces, two male and two female, which fall in sixteen different combinations, the cardinal positions. The set includes a number of pieces not made of bone, for example, shells, river pebbles and marula pits, as well as pairs (male and female) of bones from animals associated with totems. The basic principles of divination are outlined by Krige & Krige (1943: 226–227).

A

B

Fig. 100. A. Cupping-horn in use, Headman Mohale's village, 1973. B. Medicine-horns at Headman Mohale's village, 1973.

Musical instruments

1. *Trumpet*

The traditional horn for making a *phalafhala* trumpet (Fig. 101A) was that of the sable-antelope from which the instrument derives its name, but kudu horns were also used. The horn was left to dry out until the core became loose and was easy to remove. An embouchure was carved in the side of the horn at the point where the hollow is narrowest, i.e. just before the solid tip starts. If the horn showed signs of splitting it was strengthened with a skin sleeve to prevent further cracking. Horn trumpets are seldom made today but a number of old ones, belonging to district headmen, are still in use.

The *phalafhala* produces only one note but when blown hard it is loud and carrying. It was and still is associated with authority and it sounded as a signal or to make important announcements, for example to warn of a veld fire, to summon people to meet at the capital, to herald the arrival of a party of *gôsha* dancers, or to announce the arrival of tribute sent to the Queen.

2. *Whistles*

Small antelope horns were made into whistles, *dinaga* (Fig. 101B). The solid core was removed, leaving the horn-sheath closed naturally at one end and open at the other. This formed a simple stopped pipe and sound was produced by blowing across the open end. Horn whistles were used in hunting and by herd-boys. They are seldom made today as game is protected and boys spend relatively little time herding or playing in the veld. Whistles were also made from bone, often the hollow tibia of a small animal. One end was stopped and the whistle was played by blowing across the other end. According to Krige & Krige (1943: 135) during the *vyali* the Bird of Muhale communicates by whistling through an instrument made of bone but the Bird is also said to use the *mphenyi* made of reed (see p. 99).

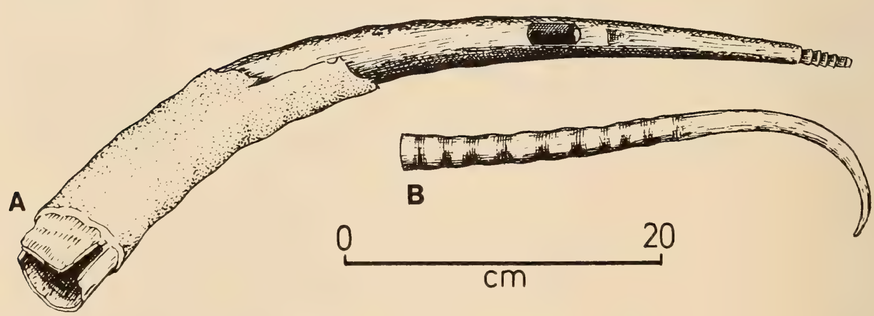


Fig. 101. A. Horn trumpet, *phalafhala* SAM–9822. B. Horn whistle, *nagana*, SAM–9818. (Both Krige Collection, 1936–8.)

Pipes

In the past dagga, *badje*, was smoked through a water-pipe that consisted of a stone pipe-bowl, *gagana* (see p. 146), a reed, *kheṱomêla*, and an ox-horn water-vessel, *naga la khomo*. The ox-horn did not require special preparation. The dagga was placed in the bowl and the reed formed the pipe-stem that was inserted into the horn of water so that the smoker could draw the smoke through the water when he inhaled deeply at the mouth of the horn.

Snuff-boxes

Horn snuff-boxes were introduced by Tsonga-speakers and their use was adopted mainly by Lobedu men. The form of the snuff-boxes (Fig. 102A–B) follows the natural shape of a horn. A hole is bored from the existing hollow through the solid tip of the horn. The wide part of the opening is then closed with a plug of wood or gourd and the narrow mouth is fitted with a small stopper. It is not uncommon for a horn snuff-box to have a carved ridge near the mouth and a thong tied below the ridge. In an unusual example (Fig. 102A) collected in the 1930s a human figure has been carved following the natural shape of the horn.

Tools

1. *Rolling-tool*

An ox-horn, flattened on one side, is used as a tool, *khehôṱhô*, to coil wire round a foundation of tail hair in making wire arm- and legrings, *masêga*.

Fig. 102. Horn snuff-boxes.
A. SAM–9850. B. SAM–9851.
(Both Krige Collection, 1936–8.)

The tail hairs, *maditsi*, are first cut, twisted, and the ends joined to form a circle. The wire is passed through a small split stick and wound a few times round the hair circlet, which is then placed on a wooden plank and stroked, *-hoţa*, in a downward movement with the horn tool so that the wire rolls evenly on to the base of hair (Fig. 103). In the 1930s brass or copper wire was bought from traders and today this had been replaced by aluminium wire. Before wire could be bought it was made by an arduous process of drawing hot metal through a perforated plate (see p. 172).

Traditionally women wore large numbers of *masêga* on their ankles (see Fig. 109) and wrists but these ornaments have become less common. Legrings are said to decrease mobility and there is an increasing tendency for young women to adopt European dress.

Fig. 103. Horn tool used to roll wire on to foundation of tail hair in making *masêga* bangles, Molototsi valley, 1976.

2. *Marula tool*

A bone tool, *lefhôḓô* (Fig. 104), is used to remove the tough skins of the marula fruits from the flesh prior to making marula-cider, *mokhobe*. The existence of a special tool for this purpose and of a special bowl (see p. 64) for drinking marula-cider is an indication of the importance of the marula fruit to the Lobedu. The fruit ripen in late January and February when crops are immature and there is little grain left over from the previous harvest. The marula season is, therefore, eagerly awaited. Marula-cider is rich in vitamin C and a source of nourishment as well as being a refreshing drink. It is usually made by women in the fields under the marula trees where it is also consumed with much enjoyment.

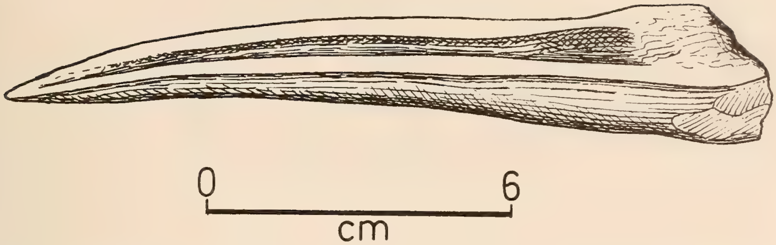


Fig. 104. Bone tool, *lefhôḓô*, for removing the skin from marula fruit, SAM–9746, Krige Collection, 1936–8.

The ripe fruits that have fallen to the ground are used to make the cider. The tough skins are removed with the *lefhôḓô* and the juice is squeezed from the flesh with a kneading action, *-soha*. The pulp and the pits are placed in a large clay pot, *thukhwana*. Water is added and the fruits are rubbed, *-suha marula*, to extract all the juice, which is then ladled into another pot, leaving the pits behind.

At this stage the juice, *lesebeta*, is left to ferment. After one day it is still very sweet and is known as *ledutu*. A layer of scum, *ledobe*, which has risen to the top, is removed. A bowl is placed over the mouth of the pot and the edges are sealed with some of the *ledobe*. Another layer of scum rises to the top of the liquid and is removed before the cider is ready for drinking. The longer it is allowed to ferment, the less sweet and more intoxicating the cider becomes. It is usually allowed to ferment for about three days before it is drunk.

Water is added to the pits that remained behind and is decanted on the following day to provide a dilute children's drink, *malithele*. Thereafter the pits are left to dry and are cracked open later for the kernels, which are ground and added to vegetable relish.

3. *Plastering-tool*

The flat rib bones of cattle are recorded as having been used at Medingen as trowels when plastering walls (Klapwijk Collection, Transvaal Provincial Museum Service K108A).

DUNG

Cattle-dung was mixed with mud to form a kind of cement used in hut construction for the plastering of walls and floors and for hardening the floor of the courtyard. The mixture of dung and mud was spread over the floor surface and compacted with a wooden beater (see Fig. 55) or a smooth stone, *thidêlô*. In the 1930s decoration of floors and walls was rare (Krige 1978 pers. comm.) but in the 1970s finger-patterns made while the last layer of dung was still wet were very popular at the capital and elsewhere in the capital district, and gave an attractive finish to the floor.

Formerly dung was used to line the inside of grain pits (see p. 140) and to fill in the spaces between the reeds of the door of a cooking-hut (see p. 85).

Dung was not generally used as fuel nor was it widely used as a fertilizer. Although it was realized that adding dung to the soil improved the crop yield, it was said also to encourage the growth of weeds, which discouraged its use (Muneri Modjadji to Holloway Commission 1930).

SUMMARY AND COMMENT

Domestic resources, the products of cultivation and livestock husbandry, are secondary resources in that they depend on the natural resources in the form of arable land and grazing, and on agricultural and pastoral technology. In the above section the uses of gourds, skins, horn, and bone are described. Fruit-shells and horns of game animals, although natural resources, are included as their technical preparation is similar to that of gourds and cattle-horns respectively.

In general the processes for which women were traditionally responsible have remained more stable than those carried out by men, and this is so in the case of calabash-making. There is no specialization in this craft as most women know how to cultivate gourds and make a variety of utensils. The continued use of calabash vessels for serving porridge seems to be related, as in the case of cooking-utensils, to the constant dietary pattern and the continued demand for calabash utensils well-suited to their varied domestic uses. It is not uncommon for enamelware to be used concurrently with calabashes for storing dry foods but calabash vessels have not been replaced for serving porridge, decanting water and, in some situations, for drinking beer.

The long-handled beer-ladle, which is passed from person to person at social beer-drinks, can be seen as expressing generosity and good social relations. At beer-drinks where bought beer tends to be consumed by individuals, the calabash ladle is not appropriate and the glass jars or tins of standard volume that are used instead reflect materially the commercial principle underlying this kind of beer-drinking.

The most important product of livestock husbandry that was used in the traditional technology was goatskin. This provided the basic raw material for skin clothing. Men processed the skins and manufactured the garments for domestic use. By the early twentieth century, however, production of skin clothing had started to decline. Migrancy imposed the need for men to adopt European dress, the mission influenced the clothing of those who adopted the faith, and these early pressures coincided in the late 1890s with the rinderpest, which almost annihilated all the livestock of the area.

Migrant labour had a further effect on the decline of skin-working by reducing the number of craftsmen. Money that migrants brought back into the area had a compounding effect by replacing goats in many traditional transactions, thus reducing the supply of skins.

Well into the twentieth century women continued to wear skin clothing as

well as the cotton cloth wraps that had become 'neo-traditional' since their widespread adoption and popularity in the nineteenth century. Even as the use of cotton clothing increased, older women often wore a skin apron underneath a cloth skirt or wrap. By the 1970s, however, skin clothing had fallen almost entirely into disuse. Old skin skirts were brought out for ceremonial occasions but new ones were seldom made and few men remembered the former techniques of making skin garments.

Among the changes that paralleled the move from skin to cotton-cloth clothing were the replacement of the goatskin baby-sling by a lighter cloth version that did not have the disadvantage of being smeared with fat, which was absorbed by the wearer's cloth wraps, and the decline in use of skin bags by men for carrying personal possessions in favour of trouser pockets.

Horns traditionally used as containers or flasks, especially for medicines, were still used for this purpose in the 1970s. The rain medicine, *mofugô*, used in a ritual of appeasement in 1973 (see p. 101) was carried to the site of the ceremony in an ox-horn flask and returned afterwards to the home of Modiga who was responsible for its safe-keeping.

Horn also continues to be used in the form of the tool *khehôṯhô*, made from a flattened horn-core and used for coiling wire round a circlet of hair to make a bangle. This tool is so well adapted to its function that it is difficult to think of an alternative that would work as well. Equally well adapted is the bone tool, *lefhôdô*, used to remove the tough outer skin of marula fruit prior to making *mokhobe* cider. The use of a specific tool for this purpose and of a special bowl, *kheritswana* (see Fig. 13C) for drinking *mokhobe* is an expression of the social and dietary importance of the marula fruit.

Although not as extensively exploited in the technology as the natural environmental resources, domestic resources supplemented the indigenous materials and were essential to the traditional material culture.

USE OF IMPORTED MATERIALS

METAL

Metal ores were not mined in the Lobedu area. The closest source of iron ore, *gwedzi*, is some distance to the north-east, and when metal-working was an active industry ore had to be carried on foot to the Lobedu smelting-sites. Krige (1941: 9) recorded that unfortunates who had no other way of earning hoes or cattle to acquire a wife carried iron-ore on foot-paths from a 'long way to the north' (probably the Tshimbupfe area) in return for a hoe per journey. The location of smelting-sites some distance from the ore source is not unusual in the Transvaal Lowveld. Archaeological evidence from the Phalaborwa area indicates that 'it is clear that smelting-sites were located near the centres of demand and distribution, rather than near the ore-supply' (Van der Merwe & Scully 1971: 182).

Copper came into the Lobedu area from Messina and Phalaborwa, which were important centres of copper production in the pre-colonial period (Wilson 1969: 173–174). According to Van Warmelo (1940: 4) until the mid-nineteenth century there was 'a constant stream of travellers going to and coming from the copper mines at Messina, where they bartered for the precious metal'. Tin is known to have been mined in the Rooiberg area and may have been traded over a wide area.

Early trade through Delagoa Bay was a source of iron, copper, and brass, and in the late nineteenth and early twentieth centuries European trade goods, including iron hoes, tools, and wire, were brought into the area in much larger quantities than before. During this period and later into the twentieth century another source of iron and metal goods was importation by migrant labourers returning from work on the mines.

Metal-working techniques

'In the old days . . . iron making was one of the great industries' (Krige & Krige 1943: 47). By the 1930s this industry had ceased largely because of two related factors—the appropriation of the ore sources by whites and the introduction of cheap factory-made metal objects, often imitations of the indigenous products, which rapidly undermined local production.

A number of Lobedu smelting-sites are said to exist. So far none has been excavated but pieces of iron-ore, *gwedzi*, and slag from the furnaces were collected by Krige (SAM–9889, 9890) from a terraced site near Modjadji's Nek. At this particular site there is also clear evidence of habitation in the form of hut-floors and daga. No historical record of Lobedu smelting-technology has been found by the author and men interviewed during fieldwork had only the vaguest memory of the processes involved. It was said that the siting of a furnace was important both in relation to the fuel supply and the prevailing winds. It was also necessary to know the types of wood that would produce very hot coals. Goatskin bellows with clay nozzles were said to have been used to keep the fire burning for many hours but technical details were not remembered.

Metal-working was a specialized industry and there is no record of the extent of Lobedu involvement in the production of metal goods. The Lobedu obtained many of their metal artefacts through trade with the Phalaborwa, Venda and Lemba, and locally from Lemba craftsmen living in the Lobedu area. The tools (Fig. 105A–D) of a Lemba smith who was over 80 years old in the 1930s are preserved in the Krige Collection. They include a hammer, *nôdô*, used for forging metal implements; tongs, *lomanô*, for handling the red-hot metal; a draw-plate, *legôkhô*, used in wire-drawing; and a vice, *bagô*. Also in possession of the smith was a tin ingot, *lekatea*, which was said by him to have been used in 'joining metals'.

Wire was made by heating a piece of soft metal, usually copper or bronze, and shaping it so that it could pass through a hole in the draw-plate. The vice securing the piece of metal was wedged in the fork of a tree while the wire was

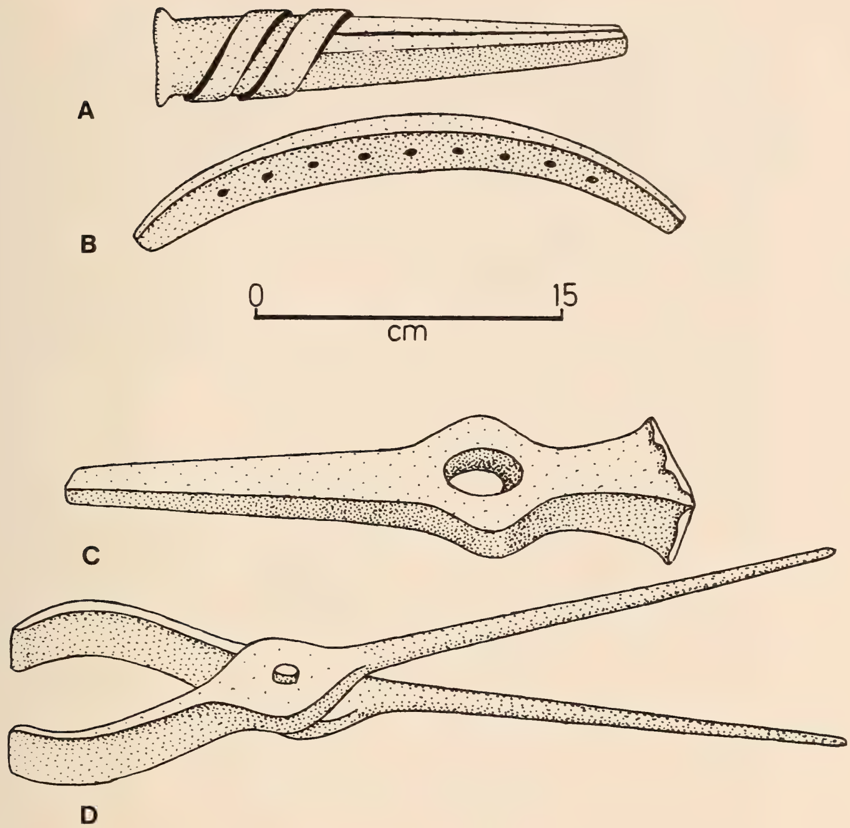


Fig. 105. Tools that belonged to a Lemba smith. A. Vice, *bagô*, SAM–9898. B. Draw-plate with holes of different size for wire-making, *legôkhô*, SAM–9896. C. Hammer, *nôdô*, SAM–9895. D. Tongs, *lomanô*, SAM–9894. (All Krige Collection, 1936–8.)

drawn out with the plate. According to Stayt (1931: 65) a forked stick was used to lever the plate as the wire was drawn out and wound round the tree. For thinner wire the process was repeated using a smaller hole in the plate.

Uses of metal

Hoes

Before the introduction of the plough, hoes, *mazhêbê*, were the most important agricultural implements and their use has continued in areas unsuitable for ploughing. In addition, hoes were important as exchange media especially in marriage contracts. Hoes so used established legally binding obligations between the kin groups involved (Krige 1964: 162).

Hoes are said to have been forged locally but many were traded from neighbouring people. In the early nineteenth century the Venda were exporting hoes

Fig. 106. Woman hoeing in the fields. Photo: E. J. Krige, 1936–8.

'in thousands to neighbouring districts' (Beuster 1879: 239) and the Phalaborwa people were also trading extensively in hoes. It is possible that specialists controlled the production of hoes as in the case of a Phalaborwa iron-worker who 'taught others to produce iron but retained exclusive monopoly over the knowledge of hoe-making' (Scully 1978: 254). Although there must have been fluctuations in the exchange rate of hoes through time and in different social and economic circumstances, it was only after the large-scale introduction of cheap factory-made hoes in the late nineteenth century that the traditional value of hoes seriously declined.

The form of hoe-heads collected in the Lobedu area in the 1930s is roughly diamond-shaped with a faint midrib running down the centre. Venda hoes illus-

trated by Stayt (1931, pl. 29) are of similar shape. For use in the fields (Fig. 106) hoe-heads were attached to a long wooden handle. In general it seems that hoes used in agriculture did not differ in shape from hoes used for exchange, except that the latter were new and not worn down through use. There is some evidence, however, of heavier, elongated spade-shaped hoes being used solely for exchange. 'These hoes were too large and heavy for tilling the soil and were merely kept in a hut' (Krige 1964: 162).

By the 1930s hoe-heads (Fig. 107) of local manufacture had come to be regarded as heirlooms that had links with the ancestral spirits. They were often partly embedded in small clay-mound shrines where offerings were made to the ancestors.

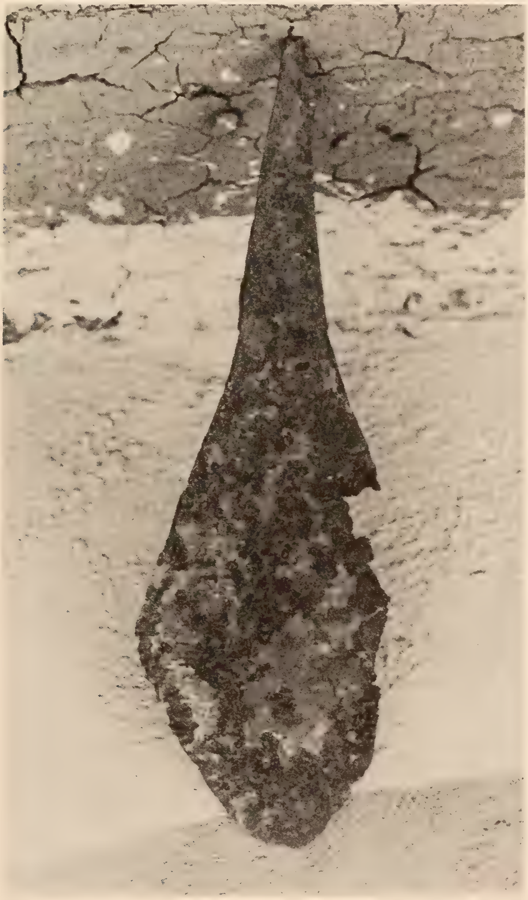


Fig. 107. Old hoe-head kept for use in ancestor rituals, Mohale's village, 1973.

Ornaments

Copper and its alloys were used for making solid neckrings and bangles, *mefhiri* (Fig. 108A), beads, *zwirogaana* (Fig. 108B) and coiled wire arm- and legrings, *masega* (Fig. 109). Ornaments made of hand-forged metal were rare even in the 1930s and are now used as amulets and regarded as '*thugula*' objects. *Kherogaana* beads of the 'wrap-around' type, i.e. made from a narrow strip of hand-worked copper cut and bent to form a circle, are among the oldest Lobedu ornaments. Individual metal beads in the Krige Collection (SAM–9910) are said to have been handed down from generation to generation as highly valued objects. Similar beads, *dithotho* (SAM–9911), made in the same way from factory-produced copper and brass were much more plentiful and less valued than the ancient copper beads. *Dithotho* beads were strung in large numbers on cotton thread to form beaded strands with tassels at the ends and were worn attached

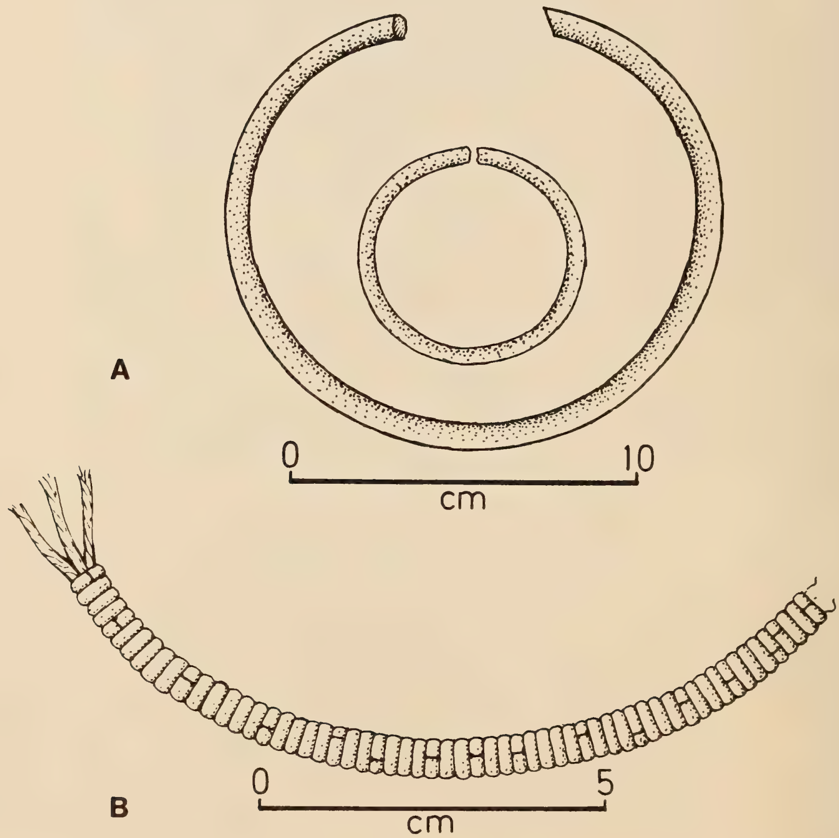


Fig. 108. A. Solid metal bangle and neckring, SAM–9908 and 9909. B. Wrap-around metal beads on thread foundation, SAM–9913. (All Krige Collection, 1936–8.)

Fig. 109. Rolled wire legrings, *masêga*, Modjadji's village, 1973.

to skin skirts. More rarely the older *kherogaana* beads were worn in strings by those who had enough of them (Krige 1983 pers. comm.).

The *mefhiri* neckrings and bangles collected in the 1930s are made of brass, which suggests that they are not as old as the copper *kherogaana* beads although they are said to have been of local manufacture. They were rare in the 1930s and in the 1970s were not seen in use at all.

Coiled arm- and legrings are still made (see p. 167) but wire of copper and brass has been replaced by aluminium wire and these ornaments are not worn in such large numbers as in the past.

Tools and weapons

When metal-working was an active industry the iron heads for tools and weapons were locally produced. Later scrap metal was used and forged into the required artefacts. More recently, purchased tools and weapons have come into use. Many of the traditional tools used in wood-working (see p. 101) and skin-working (see p. 158) had characteristically shaped iron heads that were related to their particular technical uses. The action of the craftsman in handling the tool was taken into account when forming the head and when hafting it. The long-handled gouge, *lehôrô* (Fig. 46), is a good example of this.

The following iron-headed tools and weapons (Figs 110–112, see also Fig. 61) were collected in the 1930s: adze, *bḙ̂dwana*; gouges, *mahôrô*; poker, *morô*; awl, *morogola*; nap-raiser, *mosêdô*; knife, *mofhaga*; spatula, *lehôbô*, for wiping perspiration from the face; spear, *lerumô*; axe, *zaga*; and arrow-heads, *mesêvhê*. Artefacts, locally smelted and forged, were rare in the 1930s. They

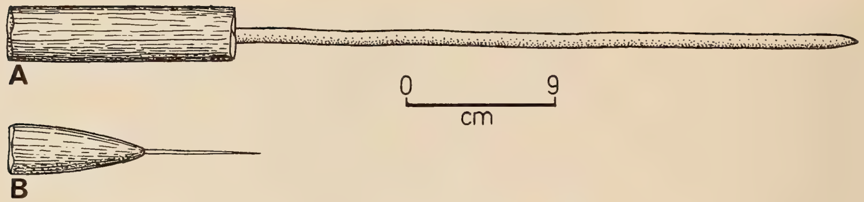


Fig. 110. A. Poker, *morô*, SAM–9725. B. Awl, *morogola*, SAM–9742. (Both Krige Collection, 1936–8.)

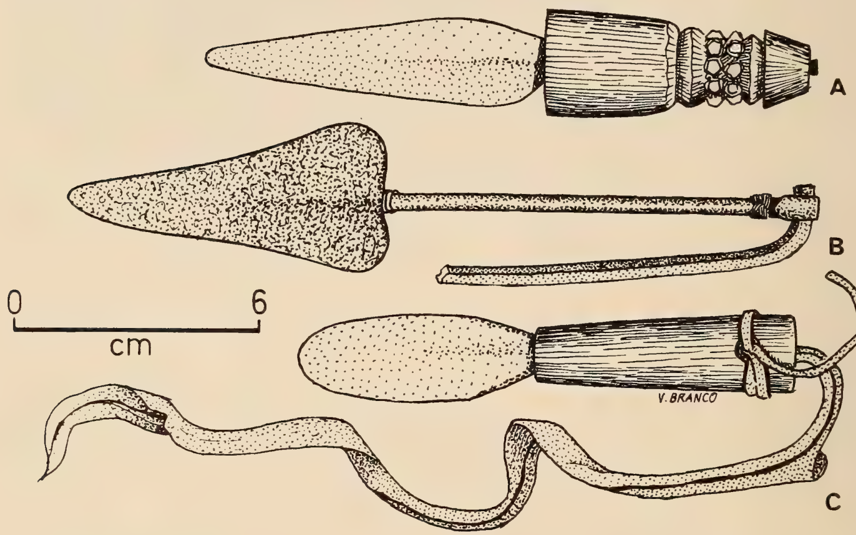


Fig. 111. A. Knife, *mofhaga*, SAM–9848. B. Sweat-scraper, *lehôbô*, SAM–9887. C. Skin-working tool, *mosêdô*, SAM–9764. (All Krige Collection, 1936–8.)

were highly valued as *thugula* heirloom objects even if rusted and in bad repair and they were thought of as links with the ancestors. These beliefs are still held by many Lobedu.

GLASS AND SHELL

A distinction should be made between Lobedu ancestral beads, which probably pre-date the eighteenth century, and glass beads of more recent origin. Ancestral beads are said to have been brought from north of the Limpopo River by the founding ancestors, an oral tradition which is substantiated by comparative chemical analysis of similar beads excavated at the Rozwi ruin at Dhlo-Dhlo (Zimbabwe) which was occupied around AD 1700 (C. Davison & Desmond Clark 1976: 132–137). Lobedu ancestral beads include those known as *modala, modzike* and *thanganwe*, that are similar in appearance and in chemical

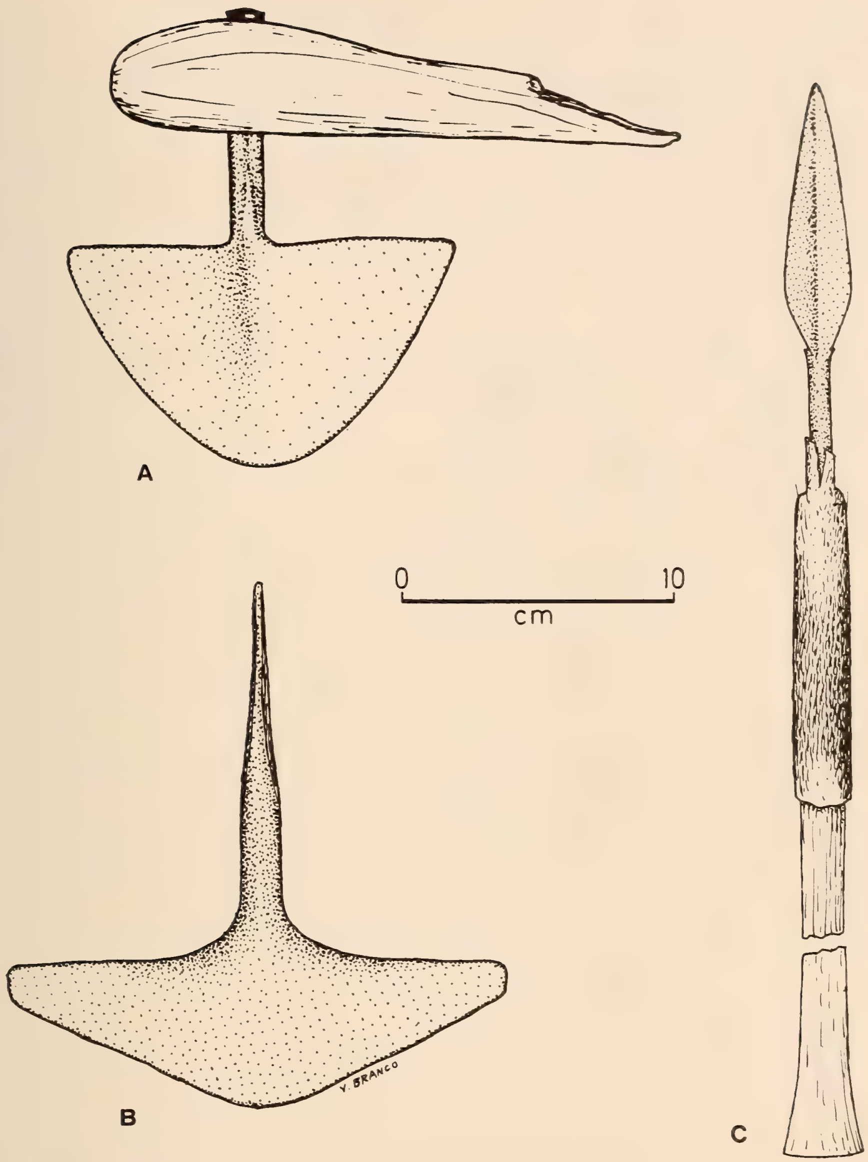


Fig. 112. A–B. Axe-heads, SAM–9884 and 9885. C. Spear-head and butt, SAM–9843. Note skin sleeve for attachment of head to shaft. (All Krige Collection, 1936–8.)

composition to the Venda 'beads of the water', *vhulungu vha madi*, described by Van Riet Lowe (1937: 368), Dicke (1937: 406), and Schofield (1958: 189–192). Ancestral beads, presented by Krige in 1937 to the Archaeology Department of the University of the Witwatersrand, were seen by the author. They include blue-green, *modala*, cobalt blue, *modzike* and *thanganwe*, red, *mokhwibidu*, green, *lethodi*, yellow, *thaha*, and opaque white, *khefhago*. Many are small cane or snap beads having a waxy, translucent quality. The dark cobalt-blue beads tend to be larger. These beads and other ancient beads were and still are regarded by the Lobedu as *thugula* or sacred objects.

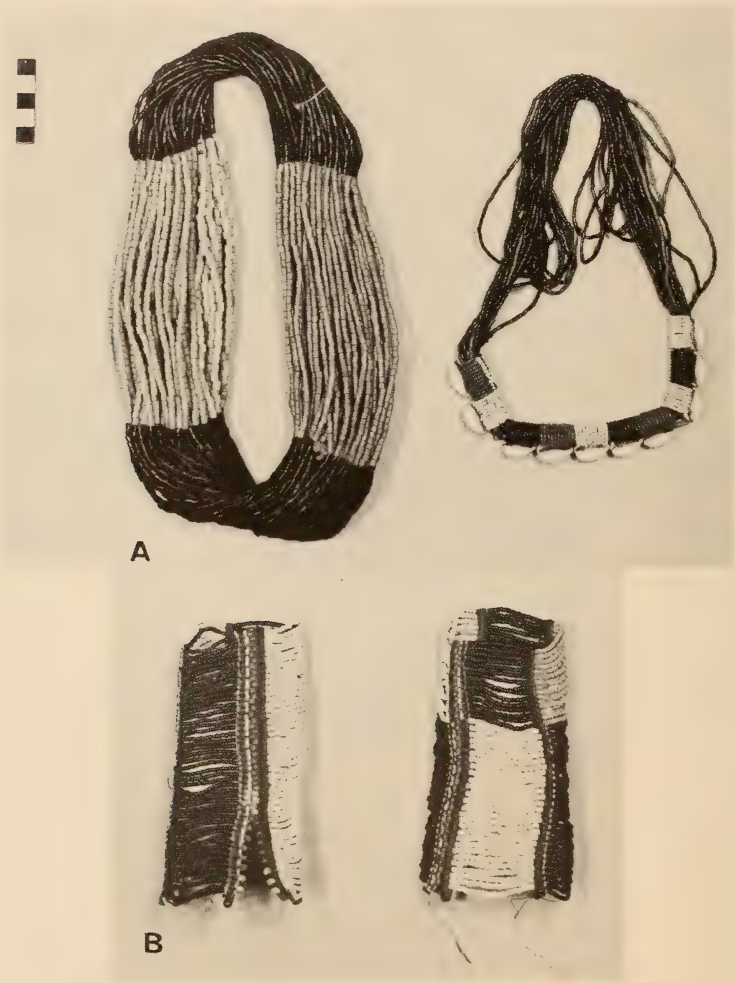


Fig. 113. Beaded ornaments. A. Necklets, *khekhaḓwa*, SAM–9781, and *ledabara la dithsêhêla*, SAM–9780. B. Armbands, *zwifhôdô*, SAM–9782. (All Krige Collection, 1936–8.)

Glass beads acquired through trade in the late nineteenth and twentieth centuries differ in appearance from ancestral beads in lacking the distinctive translucent quality and characteristic colours; they are also far more abundant. Whereas heirloom beads were usually treasured individually and used as amulets, later beads were very plentiful and were made into a variety of ornaments.

Nineteenth-century cane beads were made into a many-stranded necklet, *khekhadwa* (Fig. 113A), which was worn traditionally by a young bride when she first came to her husband's home. This necklet was also worn by recently initiated boys and girls in recognition of their new status (Krige 1982: 34). Characteristically the *khekhadwa* is strung so that it has four bands of colour composed of many strands of beads, usually green, *madalayane*, blue, *modôgwa*, yellow, *khirulwana*, and black, *lesoli*. Also worn traditionally by a young bride (Krige & Krige 1943, pl. 12b) were *zwifhôdô* armbands (Fig. 113B). The beads used were small, rounded oblates, mainly black, white, and dusky pink. They were strung in rows between pieces of hide about 13 cm in length. Old examples were strung on sinew; in more recent specimens cotton string has been used. *Zwifhôdô* armbands were also worn for dances and celebrations, together with waist ornaments, *zwibêbêdana*, which consist of multi-coloured beadwork flaps worn over a skin skirt (Krige & Krige 1943, pl. 7b). These bead ornaments are no longer made but many Lobedu women still have old pieces in their possession. The large number of examples in the Klapwijk Collection suggests that they were widely used well into the twentieth century.

In the late nineteenth and early twentieth centuries ostrich eggshell beads were brought by traders into the Lobedu area. Migrants returning from the

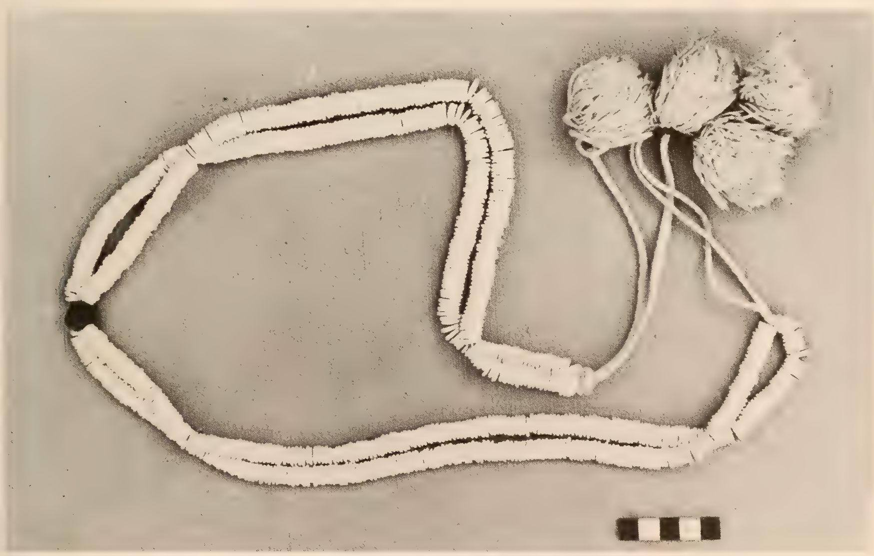


Fig. 114. Girdle of ostrich eggshell beads, *mothaga*, K102A, Klapwijk Collection.

mines could buy these beads in the Munnik and Soekmekaar areas which were said to have been centres of manufacture (Klapwijk Collection K102A, C) as were the Phalaborwa and Venda areas. Beads could be bought loose or in strings, some were roughly cut, others smoothly polished, and they were made up into *mot̂haga* girdles and worn by Lobedu women and young girls. The *mot̂haga* (Fig. 114) is a single or double string of ostrich eggshell beads with a single seed of the wild banana (*modolo*) at the centre back. Worn over a skin skirt tied in the front with the seed always at the back, the girdle was thought to have protective qualities for the wearer and to enhance fertility. They were made in large numbers and from 1900 onwards factory-made white glass beads were imported by traders to replace ostrich eggshell beads (Klapwijk Collection K102A).

Cowrie shells from the coast were traded in the Lowveld and worked into ornaments (Fig. 113A). They were thought to bring good fortune to the wearer. The cylindrical central spire of the cone shell was made into an ear ornament, *dibadana* (Figs 115–116). It was worn by women through the ear lobe in the manner illustrated by Tyrrell (1968: 62). Early *dibadana* are said to have been made of ivory (Krige 1982: 35); the shell version replaced the ivory, and porcelain copies were introduced by traders in the early twentieth century. Most, but not all, *dibadana* have a hole through the centre. They were popular in the 1930s and many photographs from that period show women wearing them. In the 1970s they were not seen in use but a few old women still had them in their possession.

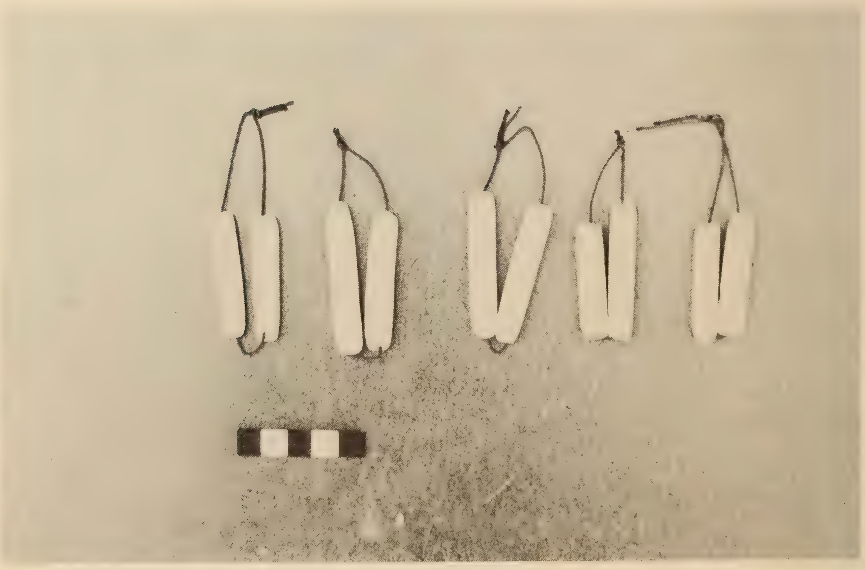


Fig. 115. Ear ornaments, *dibadana*, K68D, Klapwijk Collection.

Fig. 116. Woman and child. Note hair-style, ear ornaments and clothing, also reed door of hut. Photo: E. J. Krige, 1936–8.

CLOTH

Machine-woven cotton cloth from India and Europe was brought into the Lowveld by traders following the well-established routes from the port of Delagoa Bay to the interior. Striped salempore gained early acceptance among the Lobedu as it did among the Venda who termed it *nwalukambu*. German print

introduced by the mission became popular and has remained so among older women. Plain black morina was also an early trade cloth and it is still worn by conservative Lobedu women. In the 1970s morina and salempore wraps, *dugu yanogeni* and *dugu yahopaketa*, worn around the waist and across the shoulders (Figs 116–117) were often braided with coloured cloth at the edges and worn with a cloak, *seyi*, of coloured cotton. Local tailors took orders for machine braiding (Fig. 118). There was a wide range of cotton cloth available in the local stores but salempore and morina were still in demand by women who had not adopted modern dress.

Fig. 117. Young girl with partly shaved head wearing salempore cloth, and child wearing bead necklet, grass armbands and metal anklets. Photo: E. J. Krige, 1936–8.

Fig. 118. Local tailor, Lebiya's village, 1975.

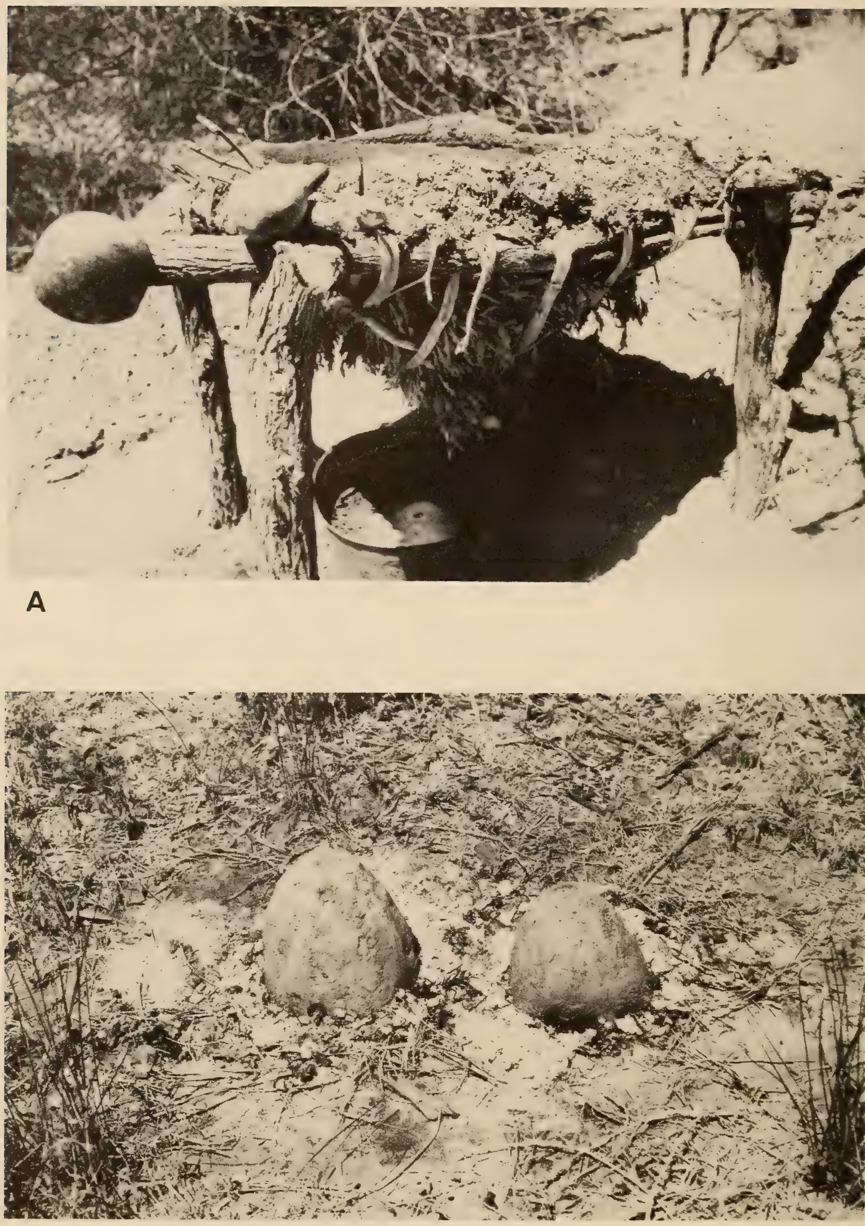
Members of the *malôbô* cult wore distinctive wraps of red and white cloth. They said that these colours were favoured by the spirits.

Cotton head-cloths, *mothini*, common in the 1970s, were not worn in the 1930s except among the Christian community. Most women shaved their heads completely but some allowed their hair to grow and styled it in particular fashions. Some young women favoured leaving a crown of hair on the top of the head, others shaved the hair to form certain styles (Figs 116–117), or parted it in a number of bands (Tyrrell 1968: 63, 65).

SALT

A small amount of salt was extracted locally from the leaves of a certain plant that were dried, mixed with water, filtered and the filtrate boiled away until the salt remained. Most of the salt used by Modjadji's subjects came from the salt-pans in the Soutpansberg to the north and from Tsonga territory to the east and was acquired through trade. Salt from pans was extracted in a filtration process that can still be observed at Sautini, a hot spring on the confluence of the Klein Letaba and Mamostwapi rivers.

The process is similar to that recorded by Junod in the early twentieth century. The salt-laden earth is filtered through large grass-lined filters (Fig. 119A) and the filtrate is evaporated, leaving the salt crystals, which are shaped into small mounds for trading (Fig. 119B). This salt is much preferred to the factory-processed product. Salt is added to the many relishes that accompany the rather bland unsalted porridge.



A

B

Fig. 119. A. Salt-filter made of mopane bark and branches, Sautini, 1973. B. Small mounds of salt drying over warm coals, Sautini, 1973.

SUMMARY AND COMMENT

The above section is concerned with materials that were not indigenous to the environment and therefore had to be obtained through trade or by travelling outside the area. The most important material in this category is iron.

Iron was essential to the subsistence economy in that the exploitation of both natural and domestic resources depended on the use of iron tools. Iron was needed for the production of the basic agricultural implement, the hoe, as well as for weapons and tools on which the technology was dependent. The fact that this essential resource was not found in the Lobedu area gave it a high social and economic value. Long distances were travelled to obtain ore, and iron objects were valued items of trade. Throughout the Lowveld hoes were used as media of exchange in trade and in marriage contracts.

Before the local metal-working industry had been largely undermined by the appropriation of ore sources and the large-scale introduction of factory-made copies of indigenous products, iron was imported from the Phalaborwa and Venda areas both in the form of ore to be smelted and forged locally, and in the form of complete artefacts ready to be hafted for use. By the late 1930s the smelting-process was no longer practised in the Lobedu area (Krige 1982 pers. comm.) and by the 1970s it was not even possible to record the complex processes formerly used. Forging iron objects, *-thula tsipi*, from any available pieces of metal continued for much longer and is still practised on a small scale by a few craftsmen (often Tsonga-speaking immigrants) using scrap metal and modern tools (Krige 1982 pers. comm.).

In the 1930s objects made of locally smelted and forged iron were rare and by the 1970s they were extremely rare. Iron tools and weapons that have not rusted away completely have been kept for religious purposes as sacred *thugula* objects believed to have links with the ancestral spirits. When beer is offered at a family shrine, it is poured over the *thugula* object, which is either embedded in the shrine or placed on it to represent its deceased owner and, by association, the ancestors in general.

By the 1970s purchased metal tools such as knives, saws, axes, nails, files, drills, hammers, and pliers, were widely used, especially in making non-traditional furniture such as chairs and benches, and in construction-work. Window-frames, doors and roof structures were made using modern carpentry tools and techniques. Although from the late nineteenth century carpentry skills had been taught to the Christian community at Medingen, these skills had not been widely implemented among traditionalists. Huts did not have windows, and the doors were either of reed or carved from a solid piece of wood. As mud-brick construction replaced the older pole-and-daga method, the structure of huts was subject to further innovation in the form of modern door-frames and windows. The construction of these fittings required the use of modern tools.

Traditional tools, however, were appropriate to their specific functions and *bêd̬wana* adzes and *lehôrô* gouges (usually with blades forged from scrap metal)

are still used for carving drums or utensils from a solid piece of wood. The important and particular relationship of tool form to artefact is apparent in this continuity of technique, despite the availability and concurrent use of modern tools.

Copper, which came from ore sources in the Venda and Phalaborwa areas, was not essential to subsistence activities but was valued as a material for drawing wire and for making beads. As in the case of ancestral iron objects, copper ornaments that pre-date their mercantile equivalents have become sacred *thugula* objects. Also in this category are the very old glass beads, some of which are believed to have been brought to the area by the founding ancestors.

Krige (1982: 32) observes that a marked characteristic of Lobedu material culture is the lack of elaboration in dress and ornamentation. She relates this to the fact that the decorative aspect of ornamentation is secondary to the association of beads with the ancestor cult and to their protective and healing powers. Secondly, she draws attention to the fact that, in contrast to the practice among exogamous Nguni groups, dress and ornamentation was not an important part of courtship as, following the preferred pattern of cross-cousin marriage, most people grew up knowing exactly whom they would marry. Ornamentation was thus only partly decorative in intent and consequently modern glass beads have had relatively little popular appeal.

Similarly simplicity characterized traditional dress even after trade cloths were adopted. The striped salempore, German prints, and black morina cotton cloths, which came into use during the nineteeth century, seem to have been accepted more for their practical advantages in a warm climate than for their decorative qualities.

The replacement of skin clothing by cloth wraps and modern garments meant that people were dependent on an imported purchased commodity for their basic clothing requirements. The traditional cloth wraps required little or no sewing but, as modern dress became popular firstly among the Christian community, there was a need for local tailors and dress-makers (Fig. 118). This involved the use of a whole range of other imported goods from sewing-machines to needles and cotton.

In the 1930s, with the important exception of metal goods, the balance between locally produced and imported material items favoured local production. Material innovations were not widely accepted except by the Christian community, and the subsistence economy was still viable. By the 1970s the transition from a subsistence to a money economy was clearly reflected in many aspects of the material culture. In addition to purchased alternatives for many traditional objects, motor cars, bicycles and a wide range of brand-name products were ubiquitous. It is relevant to consider the resilience of the traditional technology in the face of fundamental economic change.

MATERIAL CULTURE AND SOCIAL CHANGE

The present study, undertaken in the mid-1970s, aimed not only to describe the material culture but to analyse changes that had occurred during the 40 years since the Krige Collection had been made. The post-war period coincided with an unprecedented economic development of the area, growth of light industries, improvements in roads and communications, and increased white settlement following the virtual eradication of malaria. The black population of the area increased far beyond the carrying capacity of the land and the domestic economy became increasingly monetized. It is against this background of changing social and economic conditions that changes in the material culture will be viewed.

In discussion of these conditions the author is indebted to E. J. Krige (1975, 1981) for her analysis of social change among the Lobedu, as well as for extensive personal interviews and correspondence over the duration of the study. Without her analysis based on data from both the 1930s and the period 1960–80, it would not have been possible to gain insight into the interrelated nature of material and social change.

HISTORICAL, ENVIRONMENTAL AND SOCIAL CHANGE, *c.*1880–1980

The final decades of the nineteenth century were significant in Lobedu history. During this period conflict over land alienation and taxation imposed by the Volksraad of the Zuid-Afrikaansche Republiek increased, and led to confrontation and eventual Lobedu submission to imposed territorial arrangements. The fixing of the boundaries of the Modjadji Location in 1892 greatly reduced the arable land and grazing available to Lobedu farmers. White farmers settled along the Mokeetsi River and on the land south and west of the Location boundaries toward present Tzaneen. This dispossession of land coincided with the loss of cattle through diseases, the rinderpest of 1896 being the most serious. Few cattle survived this and a subsequent drought further strained the subsistence economy and gave impetus to labour migration which had occurred on a small scale from as early as the 1860s (Delius 1980: 296). Taxes payable in cash forced men to enter the labour market, which had far-reaching social and material implications. European dress was soon adopted by most men and the acquisition of expensive items such as guns, ploughs, bicycles or sewing machines was an additional incentive to earning money.

At first men stayed away from their home villages for fairly short periods, and the percentage of men absent from the reserve at any one time was relatively low, but the length of time away and the number of migrants increased steadily. In the late 1930s migrants formed approximately 37 per cent of the adult male population, by the end of the 1970s the figure was higher than 65 per cent (Krige 1981: 181) and, although figures are not available for the 1980s, there is no doubt that the number of migrants far exceeds the 1970s estimate and continues to increase and includes growing numbers of women. In the 1980s population density is such that the vast majority of people have no land to cultivate and are entirely dependent on the earnings of migrants.

From the turn of the century onward migrancy not only brought money into the rural economy and created new material needs but changed the balance of labour within the Lobedu domestic economy by reducing the number of male workers. Unlike the division of labour in Nguni cattle-based economies, in the predominantly agricultural Lobedu economy men participated actively in crop production. The reduced agricultural work force was to some extent compensated for by the use of the plough, rejected in its early heavy form but accepted later in a lighter form (Krige & Krige 1943: 325). Hoe-cultivation, however, continued in many places as much of the Modjadji Location is too steep for ploughing; furthermore, the plough had certain disadvantages—it destroyed contour walling, and was dependent on draught animals and on good rainfall to soften the soil prior to its use.

As the number of migrants increased, women played increasingly active roles in the productive economy by becoming involved in the structural aspects of hut-building, the moulding of sun-dried bricks and the making of string, baskets and mats formerly made mainly by men. The importance of women's roles in the economy as well as in social, political, and ritual organization minimized the disruptive effects of migrancy and was a stabilizing factor in the material culture, both in terms of the technology and the demand for its products.

In the late 1930s there was virtually no labour migration of women and even by the late 1970s, despite the increasing tendency for younger women to work as daily and weekly labourers on neighbouring farms or in light industries, there were still relatively few women migrants (Krige 1981: 155). In general the technical processes such as pottery and calabash-making, for which women were traditionally responsible, continued to be practised to supply domestic needs. In the case of pottery, production exceeded subsistence requirements as many skilled potters made pottery for sale as well as for their own use. This was one of the ways in which women responded to the transition to a money economy. Far from dying out, by the 1970s the practice of this traditional craft had increased to meet new needs. It is noted, however, that although in the 1970s there was widespread use of traditional technology in the domestic sphere, this was perpetuated mainly by older women and by those living at the capital which is notably conservative. Young educated women showed little interest in acquiring or practising traditional skills and looked to employment outside the area.

Post-war economic change

During the decade after World War II the previously unhealthy Transvaal Lowveld was opened up to intensive white settlement following the virtual eradication of malaria (achieved by the aerial spraying of insecticides). The consequent development of the rich mineral and agricultural resources of the area and the growth of industries ended a period of relative isolation for the local black inhabitants. There was an unprecedented demand for labour in the newly established factories, mines, and plantations. A network of new roads made possible a new form of migrant labour, that of weekend commuting to and from the

reserves. Migrants returning at weekends with cash to spend brought much needed money into the economy and also provided a welcome market for the sale of home-brewed beer, which enabled village women to supplement the wages of their husbands.

By the 1970s women had responded to the inevitable shift from subsistence agriculture (resulting from shortage of land) by seeking ways of earning money at home. Apart from brewing beer for sale, women were involved in other money-making activities such as sewing, the moulding of mud bricks, the plastering of huts and floors, and decorating of courtyard walls. By the 1980s growing numbers of women had become wage-labourers on tea-plantations, fruit-estates, and in light industry. These economic changes have had far-reaching social implications (see Krige 1981: 153–155).

Mission influence

During the late nineteenth century Lobedu values and traditions were subject to the impact of mission doctrine. In 1881 Reuter, of the Berlin Missionary Society, established a mission station at Medingen and started working among Modjadji's people. Mission teaching was opposed to polygyny, bridewealth payment, and cross-cousin marriage; it stressed free choice of marriage partners and discouraged the extended family, thereby threatening the essential character of Lobedu marriage and social structure (Krige 1981: 151). Although relatively few people were converted, the mission had a strong educational influence and provided training in technical skills, especially in carpentry and building methods, and encouraged individual enterprise and private ownership of property. By the mid-1930s it was predominantly the small Christian community (less than 5 per cent of the population) that had accepted western dress and was involved in money-making activities to enable them to meet the costs of education and the material requirements of their new way of life (Krige & Krige 1943: 320, 326).

Although early educational influences had some impact on values among a small section of the community, belief in the power of the ancestral spirits was not much undermined by the ideology of mission teaching. The institutionalized rain and fertility cult with Modjadji at its centre continued to command widespread observance of custom, reflecting the tenacity of ancestor beliefs and the importance of rain in a subsistence economy primarily dependent on crops and indigenous plant foods. Even converts to Christianity believed that Modjadji had the power to make rain, albeit by the will of God (Krige & Krige 1954: 81). Persistence of belief in the ancestors, in the power of medicines to control the forces of evil, and in the fertility and rain cult was still evident in the 1970s but the relevance of a fertility cult in an increasingly monetized economy was open to question.

Pressure on environmental resources

Pressure on natural resources and on land in particular increased significantly in the period 1930–80. This was primarily due to an unprecedented

increase in population following the implementation of National Party government policies regarding influx control of blacks in urban industrial centres and on white-owned farms. The population density more than doubled between the late 1930s and the 1980 census when the average density had reached over 200 persons per square kilometre. Of necessity much of the land formerly cultivated was taken over for settlement. Such was the population increase that many households had no fields at all. By the end of the 1970s the whole population was dependent on wage labour and on buying their staple food, maize-meal.

The productivity of the remaining farm-land has been reduced by soil erosion caused by over-grazing and the cutting back of protective bush and forest. Plant resources basic to the traditional technology have been seriously depleted and long distances must be travelled to obtain the materials required for special purposes such as initiation costumes.

The increasing demand for fire-wood and the extensive use of indigenous woods, including marula, for the firing of mud bricks has had a harmful effect on timber resources. In the 1930s marula trees were never cut for fire-wood as the nutritive content of the fruit and kernels was so highly valued (Krige 1983 pers. comm.). In times of grain shortage the marula season in February and March brought welcome relief to the hungry and bridged the lean months before the reaping of the grain harvest. The present trend reflects both the breakdown of a subsistence economy and the depletion of the environment to the extent that the basic need for fire-wood outweighs all other considerations.

Investigation of the material culture in the 1970s showed a number of responses to diminished natural and domestic resources, but the reaction to changing economic conditions was more complex than a simple substitution of new objects for old or the introduction of commodities previously unknown. The 1970s inventory of material goods included many of the objects recorded in the 1930s by Krige, but this did not mean that the pattern of their use had not changed. In some examples, such as mortars for stamping maize, the frequency of use had decreased considerably, in other cases substitute materials such as sisal had replaced the indigenous fibres. Certain traditional objects had become obsolete in response to social change, while others were used only on occasions of ritual significance. Some of the technical skills were still practised, as in the case of pottery, while others had disappeared completely. It became clear that a number of variable factors came into play in accounting for the observed changes and continuities. These included social, economic, technical, and ideological factors, the interaction of which resulted in the particular form of the material culture at the time of observation. From a closer examination of specific examples of change seen in relation to these factors, it is possible to gain some insight into the nature of change in material culture.

CHANGE IN MATERIAL CULTURE *c.*1940–80

During the 1930s when the Krige Collection was assembled, the Lobedu domestic economy was still largely self-sufficient and there was widespread

knowledge of the natural environmental resources utilized in the technology. During the 40 years under discussion, for reasons outlined above, there was an inevitable transition to a money economy. Some of the ways in which this fundamental economic change affected the pattern of use of particular utensils and structures is discussed below.

Granaries and utensils associated with harvest

In a grain-based economy full granaries may be seen as indicators of productivity and symbols of prosperity. In the 1970s, however, the disuse of granaries reflected the converse. According to Krige (1982 pers. comm.) the 1930s situation was strikingly different. Every homestead had *kheashô* or *ledulu* (see p. 142) granaries for storing maize on the cob and many also had an underground pit, *kheledese* (see p. 140), in the cattle-kraal or in the *khôrô* for the long-term storage of the decobbed maize. Large *khesêhô* grain baskets (see p. 74) for more accessible grain storage were widely used and at harvest-time temporary storage structures, *moakô* and *leṱole* (see p. 143), for millet and sorghum were set up in the fields prior to threshing (see Fig. 53). By the 1970s crop yields could not satisfy basic grain requirements and there was no surplus to be stored. The few granaries observed by the author were empty and in disrepair; grain-pits had become obsolete.

Also prominent in the 1930s was the large *moṱhaṱha* basket (see p. 69) used for carrying the harvest from the fields. As harvests declined, so did the need for this basket, added to which was the fact that enamel basins proved useful substitutes when carrying-utensils were needed. None the less, in the 1970s *moṱhaṱha* baskets were still occasionally seen in use in cooking-huts and courtyards for holding maize-meal or other foods and, in areas where cultivation continued, they were still made prior to the harvest to supply a seasonal demand.

In the 1930s harvests were large enough to require transport by wooden sledges. Fairly widely used after their early adoption from white farmers in the Lowveld, these triangular wooden sledges were no longer in use in the 1970s. Considering the soil erosion that they caused their use had been discouraged by agricultural extension officers but, in addition, the diminished harvests rendered them unnecessary.

Utensils associated with the hand-milling of maize

Ubiquitous in the 1930s, the wooden mortar, *lefudu*, and pestle, *mose* (see Fig. 52), were used two to three times a week throughout the year, the pre-dawn thud of stamping being one of the characteristic village sounds (Krige 1983 pers. comm.). By the 1970s the use of mortars and pestles for producing maize-meal was limited to a few months after the harvest. Thereafter most people were dependent on buying their staple food and the mortar and pestle were seldom used.

With the reduced domestic stamping of maize, the varied dietary pattern associated with different textures of meal produced at the successive stages in

the process of stamping (see p. 78), was largely replaced by a monotonous and less healthy diet based on highly refined, bought maize-meal.

Also related to the decrease in frequency of stamping maize was the decline in the use of the *khegôyô* mat (see p. 84) used for drying the fine meal, and the wide-mouthed *lebê̬da* pot (see p. 66) used for steeping maize during the stamping-process.

Interestingly, the *lesêlô* winnowing-basket (see p. 74), widespread in the 1930s for use during the stamping-process, remained in regular use not only for winnowing when necessary but for a number of other domestic uses. It served as a general-purpose kitchen utensil, a tray, a lid to cover the mouth of a pot, a base for drying relish, or for holding and carrying garden produce. This multipurpose utility seems to have ensured a continued demand for the *lesêlô*.

Utensils associated with cooking and the mosha

Although there was a widespread transition from home-grown to bought maize, maize-meal still remained the basis of the diet and the manner in which it was prepared and served remained relatively unchanged. Most of the traditional domestic utensils associated with cooking were still much in evidence even in the early 1980s. The *khelalêlô* cooking-pots of various sizes and *morifhi* bowls (see p. 64) were used in almost every household for preparation of the daily meal, as were the wooden spoons, *mafô* (see p. 110), and stirrers, *mafhêṯhô* (see p. 111), used at different stages during the cooking of *vhoswa*, the staple maize-meal porridge. Most cooking still took place on an open hearth in the *mosha* or inside the cooking-hut, the cooking-pot being supported by three suitably positioned stones or, in some cases, by a purchased triangular metal stand known as a 'drievoet' ('three-foot'). Having been prepared in the traditional manner, the porridge was served into well-used and often carefully repaired calabash vessels, *zwithêba* (see p. 153). The continued use of these utensils reflects the value placed on them by village women. Although used side by side with enamelware and plastic utensils, many of the locally made domestic utensils were preferred for their particular qualities and usefulness. Thus the pot, *modzêha* (see p. 60), used for storing drinking-water at home had not been replaced by tin or plastic containers because the porous, cooling quality of the earthenware made it preferable to alternative containers. For transporting water, however, lighter and less breakable containers have advantages over pottery and consequently, since the 1930s, tins and plastic buckets had entirely replaced pottery vessels for this purpose.

In addition to particular material properties that give certain utensils practical advantages, characteristic posture while working is a pertinent factor when considering the usefulness of particular objects or substitutes. Thus the hand-broom *lefielo* (see p. 89), has not been replaced by the long-handled European broom because it is more convenient to have at hand for sweeping while cooking at the open hearth. Furthermore, as Krige has observed (1983 pers. comm.), Lobedu women do not see bending down as a disadvantage because most

activities of the *mosha* are carried out at ground level in kneeling or bending position.

Earning money at home: beer-brewing for sale

The transition from a subsistence to a money economy deprived village women of their economic self-sufficiency. In most cases their husbands' wages were insufficient to meet the basic needs of food and clothing. A response to this situation was that women became increasingly involved in money-making activities at home. Whereas in the 1930s it was mainly the Christian community that made 'a business' of sewing or selling pottery, by the 1970s an informal sector of the cash economy was developing rapidly. One of the most successful ways in which women could earn money was to brew beer for sale.

A number of changes in material culture were related to the change from brewing beer largely for social or hospitality purposes, as was the case in the 1930s, to the more recent brewing of beer for sale, mainly to supply weekend commuters and visitors (access being facilitated by improved roads and transport). The increase in scale of brewing demanded larger utensils—the large clay *nkhô* (see p. 60), traditionally used in brewing beer, was replaced by the even larger '44 gallon' drum, and the woven beer-strainer, *leṯhôḓô* (see p. 86), was replaced by a capacious wooden-framed wire-gauze sieve, *sefô* (see p. 114). As neither the traditional beer-strainer, nor any commercially sold strainer was big enough to cope with very large volumes of beer, enterprising craftsmen developed the *sefô* (term taken from Afrikaans 'sif') to meet the needs of large-scale brewing. It is an interesting example of a borrowed idea modified to suit specific requirements.

By the 1970s, in addition to the time-honoured pattern of sharing beer among kinsmen and neighbours on occasions of social or ritual importance, another form of social beer-drinking had developed in response to the selling of beer. In the older 'hospitality' beer parties the utensils used were the traditional beer-pots (see p. 62) and calabashes. The long-handled calabash *khehô kha byalwa* (see p. 153) in which beer was served was passed freely from person to person, showing generosity and bonding social ties. The etiquette of the occasion was dignified and ordered, the formality being expressed in the conventional seating of men and women on either side of the server and in the use of traditional utensils. By contrast, social occasions which centred around the sale of beer were informal and traditional utensils were inappropriate. The need for containers of standard volume in which the beer could be sold to individuals was met by glass jars or tins of regular size. Instead of the beer circulating among a group of friends, the buyer tended to consume the beer for which he had paid and, as a customer, his behaviour was not subject to the etiquette appropriate to a guest. Thus the difference between these two forms of beer-drinking, both of which occurred in the 1970s (the conventional form being rare and usually associated with ritual occasions), was clearly reflected in the related utensils and in the pattern of their use.

The effect of migrant labour on the use of certain utensils

As noted previously, the migrant-labour system brought money and a wide range of imported commercial goods into the domestic economy. It also had direct and indirect implications for the manufacture and use of certain traditional utensils.

A direct response to the decrease in the number of men in rural villages was an increased participation of women in craft activities formerly undertaken mainly by men. This trend, which was noted in the 1930s in relation to hut-building and the manufacture of mats, certain baskets and cordage, continued in the following decades. Where demand for a product continued, as in the case of sleeping-mats, women became the main producers both for domestic use and for informal sale.

One of the crafts, however, that remained exclusive to men was woodworking. Women were unaccustomed to using carving-tools and the arduous work of felling trees or cutting large branches, often deep in the bush, was more appropriate to men. Furthermore, the rough carving of large objects often took place in the bush to avoid having to transport the heavy timber. Although migrancy reduced the potential number of craftsmen, there always had been some degree of specialization and enough carvers remained to supply domestic needs. Many of the carvers active in the 1970s were older men or those unable to find employment in town, who could earn some money locally by making wooden utensils for sale. Carpentry skills, which had been taught at the mission since the late nineteenth century, were in demand for the construction of new houses and other buildings within the reserve. Thus both traditional woodworking technology and introduced carpentry techniques were utilized to supply specific demands.

The direct effect of migrant labour on the customary pattern of marriage (see Krige 1981: 148–157) had indirect effects on the material culture by changing the social context in which certain objects had been of practical and symbolic significance. The decline in use of the *kherodwana* serving-basket (see p. 80) is a good example of a utensil that became obsolete as an indirect result of migrant labour. It was customary practice for a bride to take a *kherodwana* to her new home as a symbol of willingness to serve and honour her husband. In this basket, covered with a lid, she placed the daily meal that she prepared for her husband. As it became increasingly common for marriages to be contracted while the groom was working in town, the need for this special-purpose basket declined. By the 1970s it was no longer in use at all and only a few older men could recall the intricate way in which it had been made.

Material expressions of beliefs and values

In the context of ritual, objects and the materials from which they were made were invested with symbolic meaning and their use was prescribed by custom. For example, the *vuhwera* and *vyali* costumes (see p. 93), made from materials associated with rivers or damp places, were believed to enhance fertility

and prosperity. The choice of materials was based as much on a complex system of values as on technical considerations. Similarly, river stones and certain plants were believed to have 'cooling' properties and to embody positive, protective forces. The material dimension of ritual in the form of medicines, *thugula* objects, shrines, certain living plants, or offerings of beer made from *Eleusine* formed part of a much wider cognitive system that communicated meaning to those who understood the symbolic associations.

In order that meaning could be understood clearly, material symbols had to be conventional and not subject to idiosyncratic variation. The effectiveness of a non-verbal language depends on the continuity of the symbolic associations. In the Lobedu case there was evidence that knowledge of the symbols necessary to communication through ritual action and the associated objects remained alive even in the 1970s. This could be accounted for by the continued observance of customs, by the tenacity of ritual practices and by the importance of women in the sphere of ritual. In the long term, however, school education and the consequent change in values cannot but undermine the relevance of a traditional world view.

CONCLUSIONS REGARDING THE NATURE OF CHANGE

From the examples outlined above it is clear that an interplay of economic, social and ideological factors accounted for change and continuity in the material culture and that the nature of material change was more complex than simple replacement of hand-crafted artefacts by machine-made substitutes. Different kinds of change related to particular circumstances and social contexts—by the 1970s some artefacts, such as granaries, had disappeared completely in response to economic change; others, such as calabash drinking-vessels for beer, were retained for traditional social or ritual purposes, whereas modern substitutes were used when beer was sold; the physical properties of certain utensils, such as earthenware pots for storing water, made them preferable to substitutes, thereby ensuring their continued use, and the multi-purpose utility of some objects, as in the case of winnowing-baskets, made them less likely to become obsolete than utensils of more restricted utility.

Early changes in dress related to mission and school influence as well as to the requirements of town life. Social and religious distinctions were expressed outwardly in differences in style of dress and, in some cases, in colour and type of cloth. The expression of consciousness through clothing or ornamentation continues to adapt to changing circumstances. In the 1980s a trend toward 'neo-traditional' dress, arising from national consciousness, was apparent among educated women. This was particularly evident at the coronation of Modjadji V in 1982 (Krige 1983 pers. comm.).

Numerous examples confirmed that change in material culture could only be understood with reference to the wider social and economic context. The undermining of the metal-working industry that occurred before the period under discussion was a direct result of colonial appropriation of the ore sources

and smelting-sites, concurrent with the large-scale importation of cheap ironware from Europe. In addition to the fact that the termination of local production forced people to buy alternatives was the fact that many of the imported tools, such as knives, axes or saws, had practical advantages both in terms of availability and function. The saw, *saha*, for example, had no traditional equivalent and met a real need; imported knives were very efficient and easier to handle than the older *mofhago*. There was not, however, a total replacement of old tools by new. Traditional adzes and gouges (see p. 101) were still the most appropriate tools for carving certain wooden objects and the demand for them remained. From the 1930s onward this demand was met by the forging of iron (*-thula tsipi*) from scrap metal, often undertaken by Tsonga-speaking immigrants from the Phalaborwa area (Krige 1983 pers. comm.). Thus, although in the 1970s there was an apparent continuity in the use of certain tools, the method of their manufacture had changed considerably.

In the case of pottery the technology had remained remarkably constant but, in response to changing economic conditions, the scale of manufacture had increased far beyond subsistence needs. Conversely, the decline of skin-working presents an example of diminished production linked to changes in clothing customs, decreased demand for articles made of skin, and consequent decline in the related technology.

Basketry, in many respects, seemed to reflect a continuity of use and manufacture, but on investigation it turned out that women had become increasingly involved in the making of certain baskets and mats in response to the reduction of craftsmen caused by migrancy. An unqualified observation of continued use of these items might have masked the significant social change that underlay the increased participation of women in this form of production.

In view of the fundamental economic changes that have occurred over the past 40 years it is perhaps surprising that so many of the traditional technical skills have remained useful and relevant. Women in particular have proved both conservative and adaptable in this changing situation by using traditional skills to generate income and meet new economic needs. It is predictable that, as increasing numbers of women enter the labour market, the previously conservative influence of women will be reduced.

In attempting to gain some understanding of the nature of change in Lobedu material culture the limitations of a purely technological approach became apparent and it was fortunate that a wealth of anthropological data, collected and analysed by E. J. Krige, could be drawn on to inform the discussion of change. The general conclusion that can be drawn from this study supports the premise that change in material culture is inextricably bound up with social and economic factors and with ideological values; the precise nature of the links and the way they articulate depend on particular circumstances and are part of a continuous process of change.

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Nuculana (*Lembulus*) *bicuspidata* (Gould, 1845)

Figs 14–15A

Nucula (*Leda*) *bicuspidata* Gould, 1845: 37.
Leda plicifera A. Adams, 1856: 50.
Laeda bicuspidata Hanley, 1859: 118, pl. 228 (fig. 73). Sowerby, 1871: pl. 2 (fig. 8a–b).
Nucula largillierti Philippi, 1861: 87.
Leda bicuspidata: Nicklès, 1950: 163, fig. 301; 1955: 110. Barnard, 1964: 234, figs 8–9.

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PATRICIA DAVISON

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PART 3

THE FAMILIES DERMESTIDAE, CANTHARIDAE, MELYRIDAE, TENEBRIONIDAE, AND SCARABAEIDAE (COLEOPTERA)

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MORPHOLOGICAL AND BIOLOGICAL NOTES ON SOME SOUTH AFRICAN ARTHROPODS ASSOCIATED WITH DECAYING ORGANIC MATTER

PART 3

THE FAMILIES DERMESTIDAE, CANTHARIDAE, MELYRIDAE, TENEBRIONIDAE, AND SCARABAEIDAE (COLEOPTERA)

By

A. J. PRINS

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(With 24 figures)

[*MS accepted 2 April 1984*]

ABSTRACT

The immature stages of twenty species of polyphagous beetles belonging to the series Bostrychiformia, Elateriformia, Cucujiformia and Scarabaeiformia were collected along a narrow strip between Mossel Bay and Elands Bay and in small areas around Laingsburg and Tulbagh. Their morphology is illustrated and their biology and association with decaying organic matter are noted. Observations on some families of minor importance are also included. Most of the species discussed are directly involved in the breakdown of organic matter.

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INTRODUCTION AND OBSERVATIONS ON MINOR FAMILIES

During the surveys of arthropods associated with decaying organic matter thirty-four species of beetles were collected in a narrow strip along the southern and western coastal regions of South Africa and also a small strip between Laingsburg and Beaufort West as well as between Worcester and Tulbagh. Fourteen species which are mostly predacious were discussed in the second part of this series; the immature stages of the remaining twenty polyphagous species belonging to the series Bostrychiformia, Elateriformia, Cucujiformia, and Scarabaeiformia are treated here.

The Scarabaeiformia include the coprophagous, phytophagous, myrmecophilous and termitophilous scarabs, the termitophilous valgines as well as the myrmecophilous clambids, and two other small families, the helodids and dascillids. The Elateriformia, Cucujiformia, and Bostrychiformia contain species of diverse habits and all have members that are of economic importance, being either entomophagous, phytophagous, xylophagous, or pests of stored products.

The curled-up scarabaeiform larvae of the cockchafers, dung-rollers, fruit-beetles and monkey-beetles are common in most soils containing plant roots or decaying organic matter. Predacious species, however, such as ladybirds and leather-winged or soldier-beetles (family Cantharidae) have caraboid or campodeiform larvae, whereas the eruciform types of the skin-and-hide beetles and those of melyrids and clerids are often found in dried vegetable or animal matter. The trogositids (family Trogositidae) (Fig. 13C), which are near the clerids as far as larval characters are concerned, are often attracted to carcasses and cadavers during the later post-mortem stages of decay, particularly after rains.

The adult beetles are very often gregarious or congregate in large numbers, such as the orange and black-coloured ladybird, *Lioadalia flavomaculata* (de Geer), of which vast numbers are occasionally found on fresh and semi-fresh kelp strings in the supratidal and also in the intertidal zones during the early summer. There is no explanation for this behaviour, but it perhaps coincides with

a shortage of its main food supply, aphids, at this time of the year, and they are then forced to search for new resources. Masses of dead and dying ladybirds, mainly the predacious *L. flavomaculata*, together with *Adonia variegata* (Goeze), *Cheilomenes lunata* (Fabricius), and *Scymnus moreletti* Mulsant, and various other beetles and stink-bugs are often found on the intertidal zone along the west coast. These insects have been blown out to sea by strong winds and are then washed on to the beaches.

Various beetles, some of which may be of economic importance, are attracted to dry or decaying organic matter; they may play an important role in the destruction of such material, or they may merely utilize it as shelter (e.g. under large dry cow-pats), particularly in open veld with little vegetation.

In the cases mentioned below, no morphological data on the larvae could be compiled. The adults of most of the species, however, were in some way associated with, or are related to, species attracted to organic matter.

Families **Coccinellidae** and **Chrysomelidae**

Apart from the above-mentioned ladybirds, another very small predacious species, *Cranophorus varius* Weise, which, according to collection data, is endemic to the Cape Province, was attracted to carcasses where a second and third sarcophagous stage occurred after repeated rains during the late autumn and early winter. It is about 1,9 mm long, shiny brown to piceous and covered with short fine hairs.

The adults of the phytophagous ladybird *Epilachna andulata* Thunberg, and of the red and black-striped leaf-eating beetle *Chrysomela fasciata* de Geer, are sometimes found to shelter under semi-dry cow-pats. Adults and larvae of both species feed on the leaves of plants of the daisy family (Compositae) (Skaife 1953). *C. fasciata* often causes extensive damage to foliage of *Arctotheca populifolia* on the sand-dune system along the south-western coastal belt during late autumn and early winter. All the developmental stages of *E. andulata* may at times be collected on the same plant.

Pupae of another phytophagous ladybird, *Henosepilachna elaterii* (Rossi), were occasionally collected under semi-dry cow-pats along the coastal areas during autumn, together with adults of *E. andulata*. *Henosepilachna elaterii* were often associated with the black and orange-coloured *H. gibba* (Thunberg) in the Saldanha–Vredenburg area, also under cow-pats. The pupae of *H. elaterii* are yellowish with blackish spots, and the adult beetles, which emerged during March and April, are 5,8–8 mm long, cadmium yellow, with large oval black spots.

The larvae of some beetles such as certain halticids or flea-beetles (family Chrysomelidae) contain a toxalbumin, which may cause severe pain and even death in warm-blooded animals. Death by paralysis is apparently caused by a lethal saponin in the blood of the larvae of the bushman-poison beetles, *Diamphidia* and *Polyclada* spp. (Shaw *et al.* 1963). These are all yellowish beetles with larger or smaller blackish spots or marks on the elytra, and they vary from 10 to 15 mm in length. The larvae of the carabids of the genus *Lebistina*, particularly

L. peringueyi Liebke, *L. holubi* Peringuey, and *L. subcruciata* Fairmaire, which are ectoparasitic on the larvae of the above-mentioned poison-beetles, are even more poisonous than their hosts (Koch 1958). These carabids, about 15 mm in length, are also yellowish beetles, some with oblong blackish markings on their elytra. A few of these parasites and their hosts have been observed by the author under semi-dry animal droppings.

Families **Elateridae** and **Anthicidae**

Orthosomatic larvae are found in many families of which the adult beetles are associated with decaying organic matter; only in a few instances, however, have the larvae been observed in this medium. Certain click-beetles (Elateridae) such as *Lacon amplicollis* Boheman, a brownish to blackish species about 6,6 mm long, and some *Cardiophorus* spp. are often found in the veld under dry cow-pats which do not harbour carabids. Larvae of these beetles, also known as wire-worms, are elongate and cylindrical with a prognathous head, and may be predacious, phytophagous, and even luminous, as is the case with certain cantharids. Ant-beetles (Anthicidae) are common under dry cow-pats almost throughout the year, particularly the dull black *Anthicus stygius* la Ferté, and the larger shiny black *Formicomus caeruleus* (Thunberg) (about 4,2 mm long). Only one species, the shiny, dark-brown, wingless *Anthicus apterus* van Hille (Fig. 8M), was observed on carcasses during the ceratophagous stage of decay, but it was never seen on animal droppings in the veld.

Families **Ptiliidae** and **Endomychidae**

One of the most common beetles found in semi-fresh to almost dry dung is a black unidentified species of ptiliid, about 0,8 mm long. These insects, easily recognized by their feather-like wings, are some of the smallest of beetles known. Their campodeiform larvae resemble those of the rove-beetles in shape as well as in the pseudopodium-like tenth abdominal segment. They are active and are often found together with the adults even on compost heaps and decaying kelp on the beaches. According to Dybas (1976) the larval mouth-parts are not adapted for a carnivorous mode of life and they apparently feed on the organic matter and on fungus spores as in the case of *Mycetaea ovulum* Wollaston (Endomychidae). The latter is a small, oval, shiny brown fungus-beetle (about 1,3 mm long) often found in association with this feather-wing beetle, and which is, according to collection data, endemic to the Cape.

Family **Cleridae**

The chequered or clerid beetles are elongate, sombre coloured to metallic greenish or bluish or even brilliant red and yellow. Elytra are usually entire and tarsal formula is 5–5–5. The larvae are orthosomatic with a prognathous head; epicranial halves are separated by a gular area as in melyrids and the molar area of mandibles is lacking; dorsolateral glands are apparently absent in members of this family.

About 300 species have been recorded from the southern African subregion. Most of them are predacious in both the adult and larval form and are therefore beneficial; only three species, as far as is known, have become pests of stored products with a high fat content. Of these, two cosmopolitan species, the red-legged ham-beetle, *Necrobia rufipes* (de Geer), and the red-shouldered ham-beetle, *N. ruficollis* (Fabricius), occur in South Africa. Both these beetles are attracted to decaying carcasses of land and sea mammals and human corpses during the casein fermentation period. They are both long-lived and survived in the laboratory from March to January or February (a period of 10–12 months), copulation being observed during October. Simmons & Ellington (1925) give the longevity as 14 months. Larvae of both species were found to prey on the larvae of the skin-and-hide beetle *Dermestes maculatus* de Geer, and those of the cheese-skipper *Piophila megastigmata* McAlpine.

Necrobia rufipes is a metallic greenish-blue beetle (4,4–6,6 mm long) with light reddish legs. The eggs are banana-shaped, yellowish white, and those collected on a decaying turtle measured 1,10 by 0,24 mm. The incubation period in the laboratory (25–26 °C) was 2–3 days and the life-span of five larvae occupied 90–272 days on dried beef, the pupal period being 9–13 days (21–25 °C). According to Simmons & Ellington (1925) the shortest developmental period is 30 days, which includes 17 days as growing larva and 13 days within the cocoon, until emergence of adult (daily mean temperature 24,4 °C).

Necrobia ruficollis, on the other hand, is somewhat smaller (4,5–5,5 mm long, blackish blue in colour with reddish pronotum and elytral shoulders, and also with reddish legs. Eggs are similar to those of *N. rufipes*; those collected on a seal carcass measured 0,88 by 0,28 mm. The incubation period in the laboratory (21–25 °C) was 2–5 days, the larval life-span being 104–203 days under similar conditions as those of *N. rufipes*. In both species a papery cocoon is produced by the larva in which pupation occurs. The pupal period occupied 9–14 days. Descriptions of the larva and pupa are given by Heeger (1848) and Scott (1919), and a general description of a clerid larva by Peterson (1967).

Both the above species as well as the smaller *Opetiopalpus collaris* Schönherr (3,6–4,4 mm) and *Corynetinus fimetarius* Wollaston (3,2–3,9 mm) have been collected under semi-dry to semi-fresh cow-pats on the beach and further inland. Both these latter species are blackish blue, the first with reddish and the second with bronzy pronotum.

In Cape Town at least four species of clerids have been recorded in timber, mostly *Eucalyptus* and kiaat, with the adult beetles feeding on the larvae of powder-post beetles (*Lyctus* species). The largest of these is *Cylidrus fasciatus* Castelnau (7,9–9,2 mm long), a somewhat shiny dark-brown beetle with a fairly broad yellowish transverse band across the middle of its almost impunctate elytra. It is widely spread in the Subsaharan and Malagasy regions (Corporaal 1950).

Paratillus carus (Newman), the white-banded clerid, which is of Australian origin, has piceous elytra with a very narrow whitish-yellow transverse band, the head and pronotum being reddish brown. It is slightly smaller than *C. fasciatus*

(5,3–6,1 mm long). Its adults are often observed in the Cape Town docks in Japanese oak, where it feeds on both adults and larvae of powder-post beetles. It has also been introduced into England (Winkler 1960). According to Fisher (1944) it is a common predator on *Lyctus* beetles and is also one of the most numerous and active predators upon larvae of the smaller timber-borers in Australia (Froggatt 1927).

Pallenis misella Boheman (4,9 mm long) is dark brown with a narrow yellowish transverse band over the punctate elytra, but it differs from the other three species in the pronotum, which is deeply and widely excised on each side of its posterior part. It is widely distributed in South Africa, including records from Natal.

The cosmopolitan small white-blotched clerid, *Tarsostenus univittatus* (Rossi), is of similar coloration to *P. misella*, but has a narrower yellowish transverse band on the punctate elytra and is smaller (3,2–4,6 mm long); it is widely distributed in South Africa as indicated by collection records from the Sandveld along the west coast and from Transvaal. According to Laing (1928) its adults appear at almost the same time as the adults of its host. Froggatt (1927) obtained this species from wood infested with larvae of *Heterobostrychus aequalis* Waterhouse.

A metallic-blue clerid *Cylidrus wallacei* Thomson, almost 12 mm long, was found in Bellville, Cape Province, during March 1983 in *Koompassia malaccensis* logs imported from Malaysia, and which were infested with larvae and adults of the yellow-legged auger-beetle, *Xylothrips flavipes* (Illiger) and the previously mentioned shot-hole borer, *Heterobostrychus aequalis*. Both bostrychids are widely distributed in the Far East (Froggatt 1927).

Trichodes aulicus Klug, another beautiful metallic-blue species about 8 mm long, but with three orange patches on the elytra, was bred during October from the nest of a small megachilid bee in the Calvinia district. According to collection data it is widely spread in the north-western Cape Province; otherwise its habits are unknown.

Families **Colydiidae, Cucujidae** and **Ptinidae**

The cylindrical bark-beetles (Colydiidae) and the flat-beetles (Cucujidae), particularly *Euxestus phalacroides* Wollaston and *Monotoma spinicollis* Aubé, which are common during the last or ceratophagous stage of decay of carcasses, were observed to be very numerous in dry cow-dung along the west coast of the Cape Province. They were found to feed on the dry particles and were often associated with the shiny black indigenous spider-beetle, *Pseudomezium cocquereli* (Fairmaire), which is about 2 mm long. Both the first-mentioned colydiid and cucujid are widely distributed in South Africa and overseas (Hetschko 1930*a*, 1930*b*) and are small (1,9–2,3 mm long). *Euxestus phalacroides* is oval and shiny brown. *Monotoma spinicollis* is elongate and dull dark brown with serrate lateral prothoracic margins.

Spider-beetles (Ptinidae) are common in the dry decay stage of carcasses and

cadavers, and at least four cosmopolitan species occur in South Africa, of which *Mezium americanum* Castelnau and *Gibbium psylloides* (Czempinski) are almost glabrous and shiny. The latter, also known as the storehouse-beetle, usually occurs in ships carrying dried foodstuffs and is often reported as damaging maize kernels under such conditions. This species, together with the drugstore-beetle, *Stegobium paniceum* Linnaeus, and the tobacco-beetle, *Lasioderma serricorne* Fabricius, has been found in the tomb of Tutankhamun (Hinton 1945). The other two cosmopolitan ptinids, *Tipnus unicolor* (Piller & Mitterpacher), found in walnuts, and *Pseudoptinus lichenum* (Marsham), introduced from Europe, are hairy. Larvae of *P. lichenum* are known to bore in dry wood and bark of fig trees (Hinton 1941).

Another small, brown, hairy indigenous spider-beetle, *Stethomezium squamosum* Hinton, was found in the roots of the shrub *Maerua racemulosa*, which are eaten by the local people during food shortage; this shrub occurs from the eastern Cape Province to Swaziland. Hinton (1943) also records *Ptinus tectus* Boieldieu together with other beetles in the roots of this plant, as well as *Mezium natalense* Peringuey breeding in blood-meal in Zimbabwe. A rather small, unidentified, shiny-brown *Meziomorphum* sp. covered with fairly long spinose hairs and which is about 1,9 mm long, has been observed to feed on owl pellets in the vicinity of Cape Town.

Family **Nitidulidae**

Various undetermined sap-feeding beetles often appear on decaying animal matter, mostly on carcasses during the late dermatophagous and early ceratophagous stages of decay. Two well-known members of this family, the dried-fruit beetle, *Carpophilus hemipterus* (Linnaeus) and the corn-sap beetle, *C. dimidiatus* (Fabricius), are, according to collection data, widespread in South Africa. *Carpophilus hemipterus* is dark brown with large brownish-yellow marks on the elytra and was common in soil where fish-meal was used as fertilizer, together with *C. humeralis* (Fabricius), which is piceous brown with a small yellowish-red spot on the base of each elytron; this latter species is also widespread in South Africa. *Carpophilus dimidiatus* is a reddish-brown species, often found in dried figs. These are all small beetles varying in length from 2,3 to 3,5 mm.

A larger (about 4,8 mm long) and more robust dark-brown species, *Aethina castanescens* (Fairmaire), was common in chicken manure in fowl pens in the Cape Peninsula, together with larvae of house-flies, false stable-flies and lesser house-flies, and the millepede *Ommatoiulus moreleti* (Lucas), but it was absent in manure which harboured large populations of the lesser meal-worm *Alphitobius diaperinus* (Panzer), and the skin-and-hide beetle *Dermestes maculatus* de Geer.

Families **Cerambycidae** and **Curculionidae**

Apodous larvae are found among long-horned and snout-beetles. In the long-horned beetles (Cerambycidae) the larvae are elongate and somewhat

depressed. In the snout-beetles (Curculionidae), however, they are C-shaped and usually have a hypognathous head. Larvae of long-horned beetles live in wood and some are well-known pests. The adults, however, feed on flowers, leaves, and bark or pollen of plants, and only one species belonging to the genus *Stenauxa* was sometimes found among leaf litter and debris on the sand-dune system of the coastal belt, together with the coppery oedemerid, *Melananthis senex* Blair.

Adult snout-beetles, on the other hand, were common under cow-pats as well as in leaf litter throughout the entire survey area, and were represented by at least five subfamilies, of which the Eremninae predominated. At least three well-known *Eremnus* species (Fig. 1D), viz. *E. cerealis* Marshall, *E. setulosus* Boheman and *E. atratus* (Sparrman) (all endemic to the Cape Province according to collection data) were found to be plentiful under dry pats, mainly in the western Cape Province during the summer and autumn. Both *E. cerealis* (speckled snout-beetle or grain-worm) and *E. setulosus* (grey snout-beetle) were mostly observed under pats in fallow land and were collected only occasionally in the veld. *Eremnus atratus* was also found at Hermanus during midwinter. *Eremnus pilosus* Boheman, which resembles *E. setulosus* but is smaller, seems to be restricted to the south-west of the Cape Province and was prevalent throughout the spring. A small dark-brown *Eremnus* sp., about 4,5 mm long, was very common near Saldanha Bay and Paternoster, but was never collected in any other area.

The vegetable-weevil, *Listroderes costirostris* Schönherr, and *Neocleonus sannio* (Herbst) (Fig. 1A) (both widely distributed in South Africa and overseas (Csiki 1934, Voss 1973)), as well as *Rhytirrhinus inaequalis* (Fabricius) ((Fig. 1C), which is endemic to the Cape Province, according to collection data), were mostly found under dry cow-pats in the southern Karoo during the summer. However, *N. sannio* was often found along the west coast under similar conditions, together with *Rhytirrhinus acerbus* Boheman. During the late summer and early autumn very large numbers of the vegetable-weevil, *L. costirostris*, may be present under totally dry cow-pats in the sandveld area along the Cape west coast, particularly during periods of drought. In certain areas up to three hundred specimens were counted under a single large pat. *Rhytirrhinus* and *Listroderes* are more or less the same size (7,5–7,8 mm long), but these two species of *Rhytirrhinus* are easily distinguished by the strong carinae on the elytra. *Neocleonus sannio* is much larger (12–13 mm), light grey in colour and marked with four to six brown patches on the elytra.

A tiny, dull-black species of *Ocladius*, about 3,7 mm long and almost globular in shape, with rugosoreticulate elytra and the pronotum with rows of parallel, longitudinal, thin carinae connected with cross-ridges, was found under dry pats in the Karoo during the late summer and autumn. At least one species of *Rhysoderes* (Fig. 1B) was found to shelter under cow-pats near Saldanha. It is 6,6–8,0 mm long, brownish grey, with head and pronotum rugosopunctate.

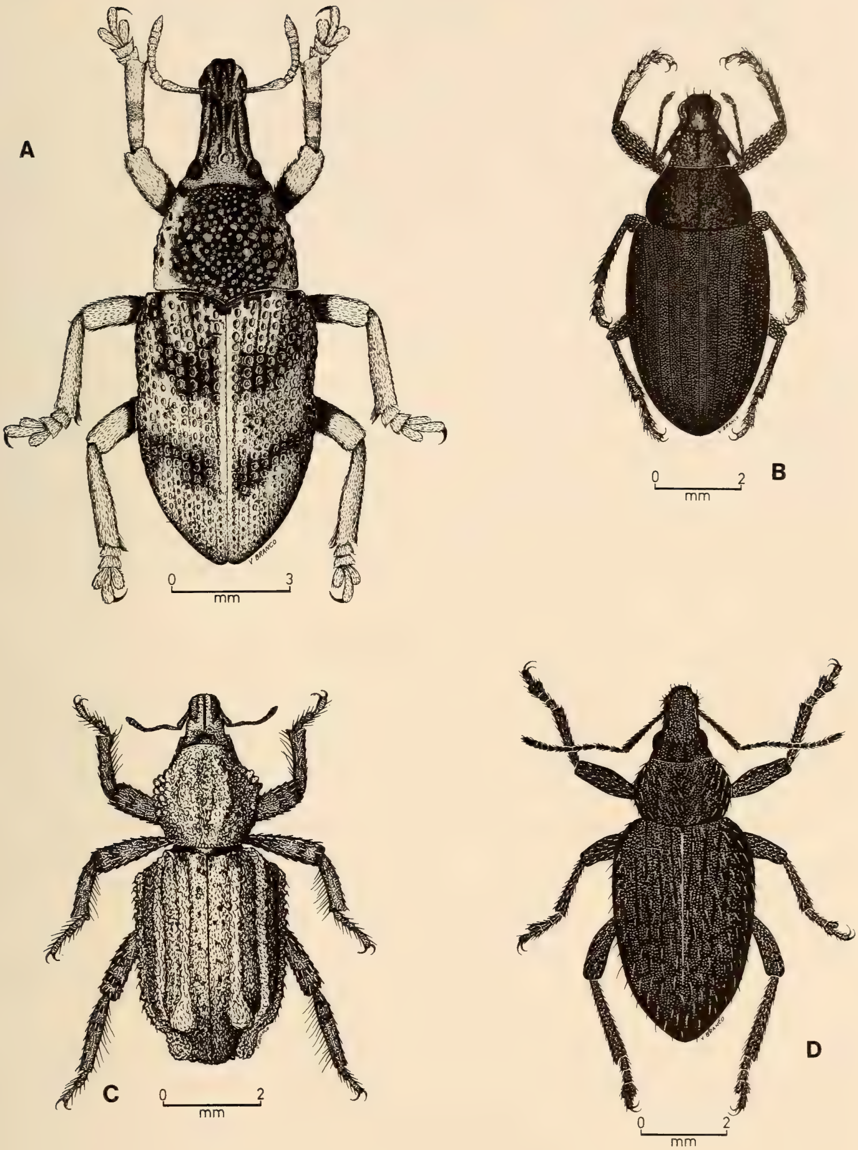

Fig. 1. Curculionidae. A. *Neocleonus sannio*. B. *Rhysoderes* sp. C. *Rhytirrhinus inaequalis*. D. *Eremnus* sp.

MORPHOLOGICAL DESCRIPTIONS AND BIOLOGICAL NOTES

The systematic arrangement followed is that of Britton (1970).

SERIES BOSTRYCHIFORMIA

Family **Dermestidae**

Small to medium-sized oval to somewhat elongate beetles, usually of sombre coloration, often with coloured pattern due to the arrangement of scales on the body. Head small and deflexed with clubbed antennae. Hind wings well developed, elytra covering the abdominal segments. Tarsal formula 5–5–5.

Of the nearly 500 species described, only about forty have been recorded from southern Africa, of which at least ten species are of economic importance. Hinton (1945) gives a good account (including illustrations) of the various species. Dermestids are scavengers and feed on dried animal and vegetable matter with a high protein content, and some species are therefore attracted to decaying organic matter such as carcasses or cadavers, particularly during the formation of butyric acid and other volatile fatty acids. Many species are found in nests of insects and other higher animals, including birds and small mammals, often killing the young, and a few are even predacious, feeding on the immature stages of other insects such as the larvae of the wax-moth, *Galleria mellonella* Linnaeus, in beehives.

Apart from the fact that the hairy larvae may cause dermatitis in sensitive people, due to the liberation of histamine stimulated by urticating hairs (Smith 1973), there is also the danger of diseases such as anthrax (*Bacillus anthracis* Koch) being spread by these beetles. The hairs of some species may remain in the grain on which the larvae were feeding and may have serious effects when swallowed (Morison 1925).

The larvae are easily recognized by their long body hairs, which may be simple or modified, and members of the genus *Dermestes* have, in addition, paired sclerotized urogomphi. They do extensive damage to stored foodstuffs (grain and cereal products, dried fish, bacon, biltong, dried sausages, ham, etc.), carpets, leather, feathers and hair, beeswax, clothes, skin and hides, bone, insulating materials and museum specimens. Larvae and adults recovered from Egyptian mummies had caused considerable damage to the embalmed bodies (Strong 1981). At least eleven species of beetles were found in the skull of an Egyptian mummy (Hope 1834), of which four were skin-and-hide beetles, viz. *Dermestes maculatus* de Geer, *D. peruvianus* Castelnau, *D. frischii* Kugelann, and *D. roei* Hope. Dermestid larvae will attack laminated boards or even plaster-of-paris models if they contain glue of animal or vegetable origin, and when ready for pupation they will perforate roof timbers, wooden panels, and even lead sheeting. Under adverse conditions they may turn cannibalistic.

There are at least three vegetarian species of *Trogoderma*, of which the well-known cosmopolitan Khapra beetle *T. granarium* Everts, is the most important. It is a serious pest of stored grain elsewhere in the world, but is apparently not

established in South Africa. However, it was reported from a brewery in Pietermaritzburg in malt imported from England as early as 1953, and from near Pretoria in 1955 when a heavy infestation of this beetle and some other grain insects occurred in a store in sweepings that had been allowed to accumulate for about three years.

The carpet-beetles include at least six cosmopolitan or nearly cosmopolitan species that have been recorded from South Africa, including the widely distributed varied carpet-beetle, *Anthrenus verbasci* (Linnaeus), also known as the museum-beetle, which is so destructive to dried museum specimens, and the true museum-beetle, *A. museorum* (Linnaeus), reported in the past only from South West Africa. The furniture carpet-beetle, *A. vorax* Waterhouse, which is very similar to *A. verbasci*, but is easily separated from the latter by the inner or mesal margin of the eyes, which is excised or interrupted in the middle (entire in *A. verbasci*), has been observed in nests of the social weaver-bird (*Philetairus socius* (Latham)). The larvae feed on feathers and other debris. One of the more common species found in carpets, bird carcasses and poultry manure in the western Cape Province is the cosmopolitan black carpet-beetle, *Attagenus piceus* (Olivier), which is more elongate than species of *Anthrenus*; it is occasionally found in association with the indigenous *Attagenus jucundus* Peringuey and the nearly cosmopolitan *A. gloriosae* (Fabricius) in carpets in the Cape Peninsula.

Skin-and-hide beetles are common in decaying carcasses, both on the beach and inland, in fish-meal, dried fruits, animal droppings, and even horn, feathers, and biscuits. Four cosmopolitan species are recorded from South Africa, of which *Dermestes maculatus* and *D. peruvianus* are the most numerous in the western Cape. *Dermestes ater* de Geer, although widespread, is a more northern species, whereas the larder-beetle, *D. lardarius* Linnaeus, is only found occasionally in the Cape Town docks, mostly in dried foodstuffs such as macaroni and walnuts.

Dermestes maculatus de Geer

DESCRIPTION

Adult

Previously described by Hinton (1945). Blackish, dorsally clothed with decumbent fulvous to greyish hairs, with mostly head and a broad band along each lateral margin of pronotum covered with longish white hairs. Apex of each elytron serrate and sutural angle produced in form of a strong tooth, absent in the other two species described here. Lateral impressed line of first sternite curved inwards near base. Length of specimens examined varying from 5,5 to 10 mm.

A native of Europe and widely spread in most parts of the world (Hinton 1945). It is the most common skin-beetle around Cape Town and is also well established on most of the islands along the South African south and west coasts, including Dyer, Bird, Marcus, Jutten, Ichaboe, and Malgas islands.

Larva (Fig. 2A)

General descriptions are given by Rees (1943), Hinton (1945), and Peterson (1967). Body form of *Dermestes maculatus* larva elongate, semi-circular; tergites sclerotized and piceous to dark brown with broad, pale yellowish-white median, longitudinal line over dorsum, representing ecdysial suture. Head hypognathous. Tergal plates covered with medium-long to very long spinulate setae, some hairs on third to eighth abdominal segments somewhat longer than others. Spinulate hairs on ventral side paler and shorter. Integument smooth, without spinules except for short branched (spinulate) spines on certain areas. A transverse row of strong pointed tubercles present on anterior margin of dorsal sclerotized plates of abdominal segments 4–9 (Fig. 5A–B). Spiracles well developed, mesothoracic one the largest, oval (Fig. 2C); first three abdominal spiracles less oval and situated on a non-sclerotized membrane below sclerotized tergal plates, those on fourth to eighth segment smaller than other abdominal spiracles, almost circular and situated on the sclerotized tergal plates (Fig. 5A); in pale-coloured larvae they are often less sclerotized than others (Fig. 2D). Legs pale brownish to brown, tarsungulus (Fig. 3L) dark brown, and with short narrow keel-like projection ventrally on each side of which is a long fine seta. Setation of posterior face of tibia as in Figure 3L; characteristic of *D. maculatus* is the long fine posterodorsal preapical seta on tibiae. Length of full-grown larva about 15 mm.

Head (Fig. 2E–G)

About as wide as long, or only slightly wider than long, sides and hind margin dorsally fairly convex. Frontal and epicranial (coronal) sutures distinct; frons strongly sclerotized except for narrow strip along anterior border and on each side in front of antennae; each side of frons with strong conical tubercle. Epicranium also strongly sclerotized, except for small area around ocelli; latter six in number, on each side arranged in two almost vertical parallel rows. Setation more or less as illustrated. Antennae (Fig. 2B) three-segmented with whitish cone-shaped basal articulating membrane; first segment slightly more than half the length of second, wider than others; with about six setae situated dorsally some distance from its apex; second segment with sensory appendix (sensory cone) at apex and an oval sensory spot near middle. Third segment small, about one-third the length of second, with sensory pegs at apex.

Labrum and clypeus

Labrum slightly more than half the length of clypeus, narrower than latter, its anterior margin fairly deeply and angularly excised in middle. Clypeus trapezoidal, much narrower in front than behind; anterior margin slightly concave, preclypeus without setae, except for medium-long seta on each side near lateral margin; postclypeus with about six to eight medium-long setae.

Epipharynx (Fig. 2H) with proximal sensory area composed of about six large and ten small sensory papillae arranged in two almost parallel rows. Epipharyngeal scleromes parallel, tapering and somewhat diverging posteriorly.

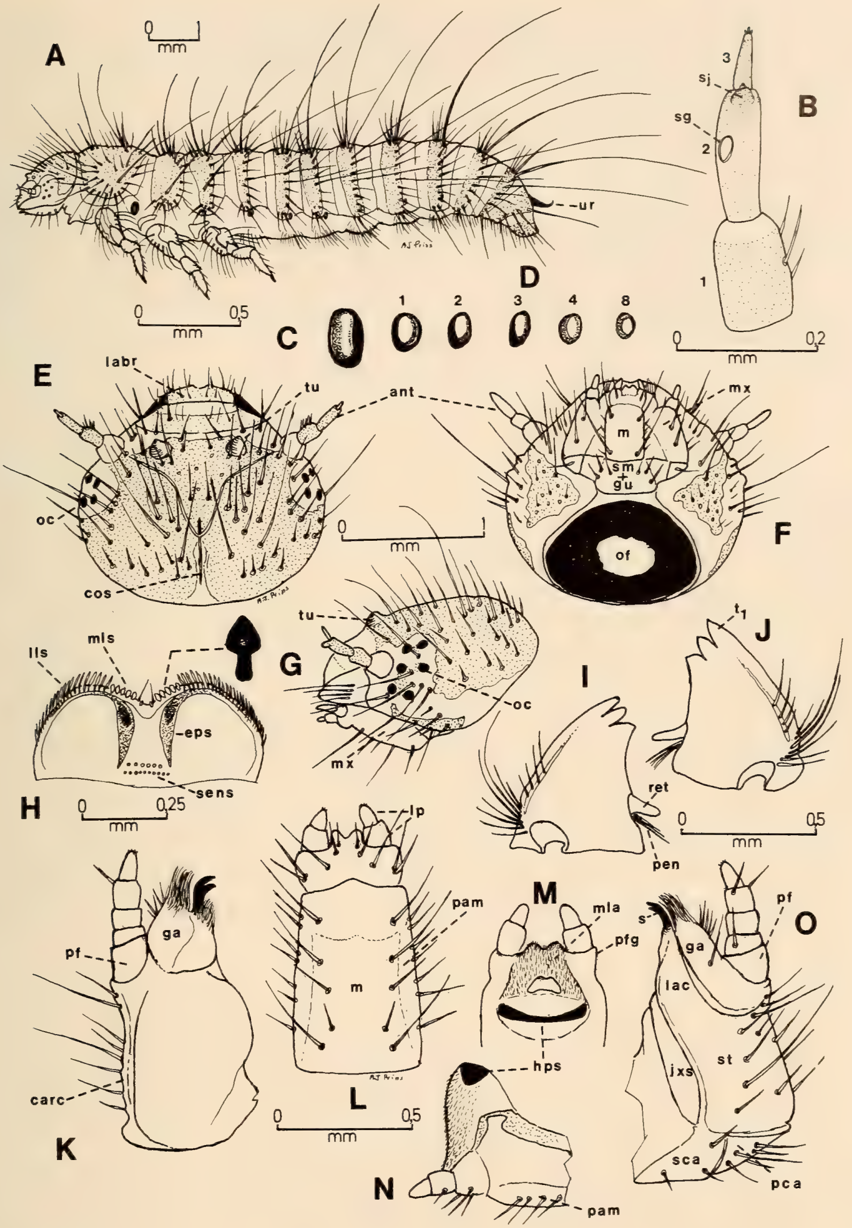

Fig. 2. Dermestidae. *Dermestes maculatus* larva. A. Full-grown, left lateral view. B. Antenna. C. Mesothoracic spiracle. D. Abdominal spiracles, segments 1–3, 4, 8. E. Head, dorsal view. F. Head, ventral view. G. Head, left lateral view. H. Epipharynx. I. Left mandible, dorsal view. J. Right mandible, dorsal view. K. Left maxilla, dorsal view. L. Labium, ventral view. M. Labium, dorsal view. N. Labium, left lateral view. O. Left maxilla, ventral view.

Broad median lobe setae about five in number on each side, lateral lobe setae longer and finer and covering each lateral margin to a point well beyond its middle. Also two sensory pegs situated in median V-shaped excision below two dorsal median setae.

Mandibles (Fig. 2I–J)

Broad, almost triangular and slightly less than one-third the length of head. Cutting edge tri-dentate, apical tooth (t_1) somewhat larger than others. Molar area absent, but represented by large stiff process of retinaculum and brush of hairs or penicillus. Lateral face with demi-scrobe with about four setae of which the distal two are longer than others; also transverse row of hairs near base of mandible on lateral face, with median hairs the longest.

Maxillae (Fig. 2K, O)

Galea and lacinia united, only free at extreme apex, the boundary lines clearly indicated on both sides. Lacinia with forked spur at apex and dorsally also with brush of fine fulvous hairs, otherwise devoid of setae. Galea lobe-like with brush of fine fulvous hairs apically and four to five short setae on external lateral margin just below brush of hairs, as well as one somewhat longer seta on ventral side near palpifer. Stipes broad, almost quadrate with some setae on ventral side of which one is much longer than rest; dorsally without setae; also some medium-long setae along its ridge-like exterolateral margin. A narrow juxtastipes present, demarcated by sclerotized margin of stipes. Palpifer without setae. Maxillary palp four-segmented, the segments somewhat tapering towards apex; first and second segments of about equal length and somewhat shorter than third and fourth in specimens examined; first segment with a single ventral seta, the penultimate one with two setae, one lateral and one ventral; apical segment with some sensory pegs at apex. Subcardo and precardo (alacardo) clearly indicated by sclerotized demarcation line; former with only about three, latter with about seven setae.

Labium (Fig. 2L–N)

Submentum and gula fused, mentum almost rectangular, longer than wide with setal pattern as indicated in figure, including longitudinal row of setae on lateral face (paramentum). Ligula cleft in middle, ventrally with about five setae on each lobe as indicated; hypopharyngeal sclerome as a curved sclerite and raised above the palpi in all specimens examined, superlinguae beset with minute setae. Labial palpi two-segmented, tapering towards apex, segments of about equal length, without setae except for sensory pegs on apical one.

Pupa (Fig. 3A–B, E–G, J)

Somewhat elongate, about two and a half times longer than wide when seen from above, creamy white in colour; completely covered with fine medium-long fulvous hairs, each hair growing from a small rounded tubercle, which is coloured

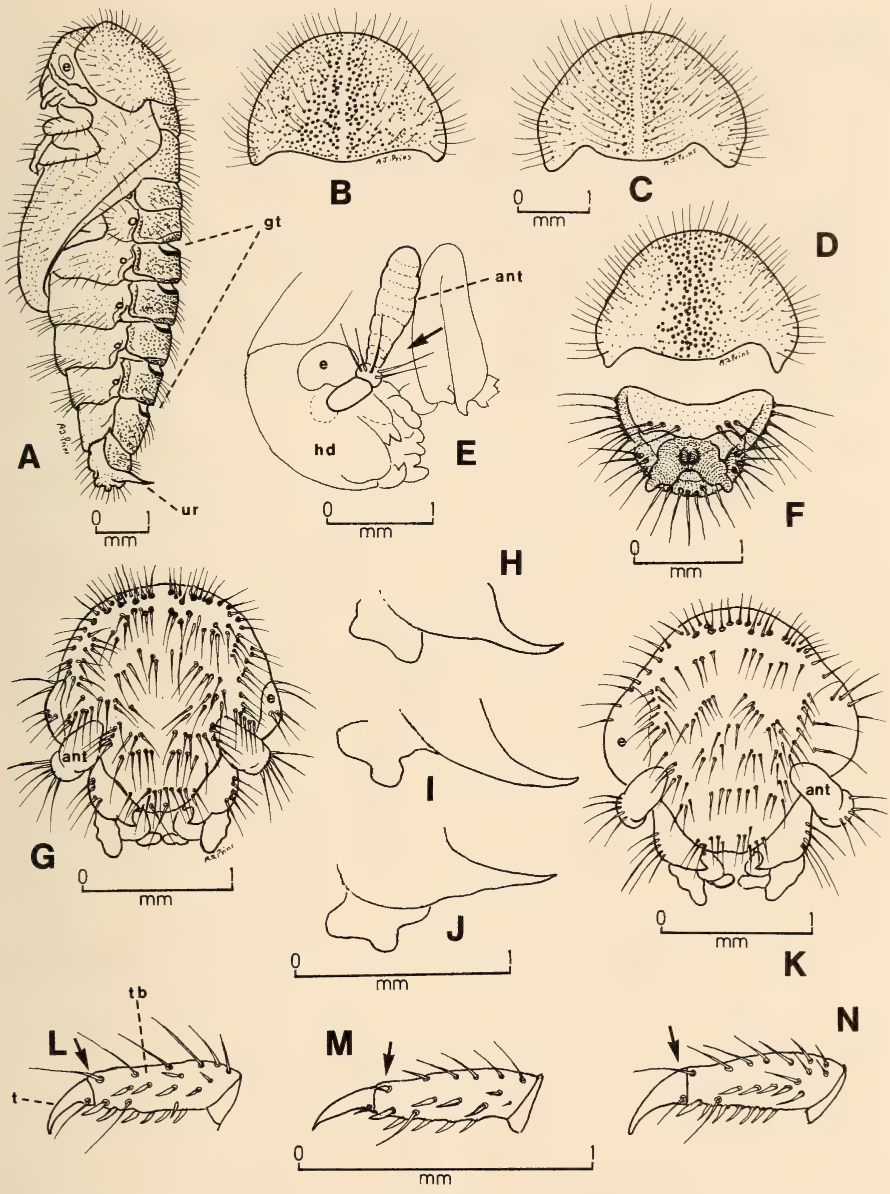

Fig. 3. Dermestidae. A. *Dermestes maculatus* pupa, left lateral view. B. *Dermestes maculatus* pupa, pronotum, dorsal view. C. *Dermestes ater* pupa, pronotum, dorsal view. D. *Dermestes peruvianus* pupa, pronotum, dorsal view. E. *Dermestes maculatus*, antenna of pupa, left lateral view. F. *Dermestes maculatus*, abdominal apex of pupa showing developing genital capsule, ventral view. G. *Dermestes maculatus*, head of pupa, dorsal view. H. *Dermestes peruvianus*, urogomphus of pupa, left lateral view. I. *Dermestes ater*, urogomphus of pupa, left lateral view. J. *Dermestes maculatus*, urogomphus of pupa, left lateral view. K. *Dermestes peruvianus*, head of pupa, dorsal view. L. *Dermestes maculatus*, tarsungulus and tibia of left front leg of larva, posterior view. M. *Dermestes ater*, tarsungulus and tibia of left front leg of larva, posterior view. N. *Dermestes peruvianus*, tarsungulus and tibia of left front leg of larva, posterior view.

yellowish red; tubercles and their coloration more prominent on median dorsal side of pupa, particularly in newly formed pupae; those on pronotal disc somewhat larger than others. The five so-called 'gin-traps' on third to seventh abdominal terga coloured reddish and very distinct, even in old pupae. Spiracles large, almost circular on abdominal segments 1–6, that on seventh smaller and less obvious. Two urogomphi vertical and almost parallel. Developing genital capsule in form of two swellings as indicated in figure.

Characteristic of the pupae of all three species of skin-and-hide beetles examined are the six to ten setae on the second ringlike segment of the antennal sheath (Fig. 3E). These setae are also present in the pupae of *Attagenus piceus*, in which case there are six 'gin-traps'. In all the pupae of *Anthrenus verbasci* that were examined these setae and the 'gin-traps' were absent.

BIOLOGY

In most species of dermestids the adult beetles need food and access to a water supply for satisfactory reproduction. This was also found by Dick (1937), who states that if beetles were allowed to drink they would continue to lay eggs for 72 days. This is not the case with the smaller carpet-beetles such as *Anthrenus verbasci*, which are able to complete their adult life and lay eggs without any feeding.

The eggs of *Dermestes maculatus* found in decaying carcasses were dirty white and minutely and longitudinally striate and also reticulate when viewed at a certain angle. Most eggs examined varied from 1,30 by 0,54 to 2,04 by 0,92 mm and were fairly dull.

In larvae reared in the laboratory on their natural food supply, the larval life-span varied from 31–42 days during January to March, the pupal stage being 7–11 days. During April to May they needed about 50 days to mature and the pupal stage was about 35 days. Pupation occurs in the larval skin in the soil without the formation of an earthen cell.

The newly emerged beetle is pale yellowish white with the abdominal apex reddish; pronotum pale reddish surrounded by a yellowish-white, broad border. Legs pale, trochanters, tarsi and articulation points of femur, and tibiae reddish; head also pale reddish, eyes brown, antenna reddish with the apical three segments piceous brown, and apices of mandibles black. After a few hours they assume their normal dark coloration.

As indicated previously, during the act of pupation the larvae will perforate any suitable material for this purpose and may cause severe damage to timber in buildings. In the past various instances have been recorded where larvae of this species caused damage amounting to thousands of rands where laminated boards and wooden panels contained animal glue. It is also possible that the larvae may consume some of the wood as part of their diet. This fact is also stressed by Bedwell (1931) when he refers to the smooth hollowed-out parts of the timber and the presence of the larvae in various stages of development.

During the surveys it was observed that the larvae of *D. maculatus* very often

feed on their own pupae and they in turn are heavily preyed upon by larvae of the ham-beetles, particularly *Necrobia rufipes*, which sometimes occur together with this species.

Dermestes ater de Geer

DESCRIPTION

Adult

Previously described by Hinton (1945). Dark castaneous to piceous, integument somewhat more shiny than in *Dermestes maculatus*; body hairs fulvous. Lateral impressed line on first sternum widely curved inwards, only parallel to lateral margin for about half its length (in *D. maculatus* it is parallel for most of its length). Elytral apices without serrations and without sutural teeth. Length varying from 8,3 to 9,5 mm.

Indigenous to America (Fauvel 1889) and widely spread in the world (Hinton 1945). Only occasionally observed in the Cape Town docks.

Larva

Very similar to that of *D. maculatus* (see Fig. 2) in size, body form and setation including spiracles, except for pro-mesothoracic spiracle (Fig. 4B), which in *D. ater* bears about twelve almost equally developed ventral setae, whereas in all specimens of *D. maculatus* that were examined, there were only one strong and about five weaker setae. In this species, as in *D. maculatus*, the first three abdominal spiracles are situated on a non-sclerotized membrane below sclerotized tergal plates, but the abdominal segments are devoid of a transverse row of strong tubercles (Fig. 5C–D). Urogomphi straight (Fig. 5D—in *D. maculatus* slightly curved upwards and anteriorly), and tibiae (Fig. 3M) each with stout dorsal spine on posterior face near apex (in *D. maculatus* it is replaced by long slender seta); short spine-like ventral seta present on each side of base of tarsungulus (in *D. maculatus* these setae are long). In most specimens examined the median, longitudinal yellowish band over the dorsum in the form of a thin line, forming a diamond-shaped patch in middle of each segment.

Head (Fig. 4A)

Very similar to that of *D. maculatus* in shape, sclerotization and setation, but lacking tubercles on frontal area. Six ocelli on each side arranged in more or less two groups of three each, as illustrated. Frontal and coronal sutures distinct. Head of most specimens examined with somewhat more setae than in *D. maculatus* (see Fig. 2E–G), particularly on frontal area. Antennae also very similar to those of latter species, including six dorsal setae on first segment; the sensory appendix, however, seems to be somewhat smaller.

Labrum and clypeus

Very similar to those of *D. maculatus*, including emargination in middle of anterior margin of labrum. *Epipharynx* (Fig. 4E) also similar and with double

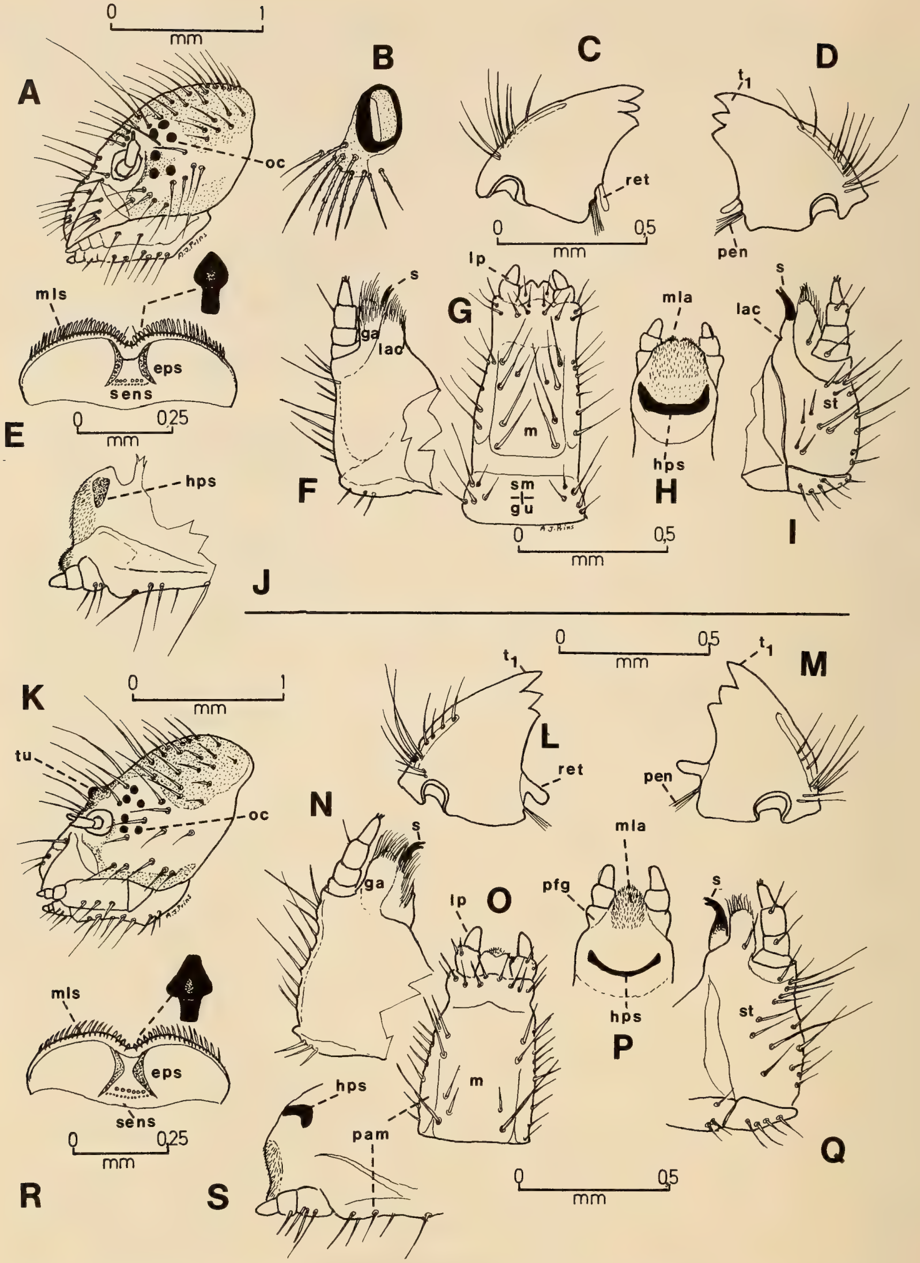

Fig. 4. Dermestidae. A–J. *Dermestes ater* larva. A. Head, left lateral view. B. Promesothoracic spiracle, left lateral view. C. Left mandible, dorsal view. D. Right mandible, dorsal view. E. Epipharynx. F. Left maxilla, dorsal view. G. Labium, ventral view. H. Labium, dorsal view. I. Left maxilla, ventral view. J. Labium, left lateral view. K–S. *Dermestes peruvianus* larva. K. Head, left lateral view. L. Left mandible, dorsal view. M. Right mandible, dorsal view. N. Left maxilla, dorsal view. O. Labium, ventral view. P. Labium, dorsal view. Q. Left maxilla, ventral view. R. Epipharynx. S. Labium, left lateral view.

row of proximal sensory papillae, the front six large, arranged in two groups of three each in most specimens seen; posterior row with about fourteen minute papillae. Epipharyngeal scleromes also similar to those of *D. maculatus* (see Fig. 2H); broad median lobe setae about five in number on each side; lateral lobe setae spear-shaped and covering each lateral margin to a point just beyond its middle.

Mandibles (Fig. 4C–D)

Very similar to those of *D. maculatus*, including demi-scrobe and transverse row of hairs; however, retinaculum much narrower and penicilli much broader in most specimens examined than in that species.

Maxillae (Fig. 4F, I)

Similar to those of *D. maculatus* (see Fig. 2K) and without any setae on dorsal side, except for hair brushes on galea and lacinia. Setal pattern of ventral side similar to that of latter species. Demarcation line between galea and lacinia fairly distinct, the spur as in *D. maculatus*. Maxillary palp with third and fourth segments of about equal length and both slightly longer than first and second; apical segment narrowest; setal pattern, subcardo and precardo exactly as in *D. maculatus*, except no setae could be traced on subcardo.

Labium (Fig. 4G–H, J)

Very similar to that of *D. maculatus*, including shape, setal pattern, labial palpi and hypopharynx.

Pupa

Also very similar to that of *D. maculatus* in colour, body form, size and shape of developing genital capsule, but differing from it by the somewhat smaller hair tubercles, which are more or less confined to median area of tergites, particularly the pronotum (Fig. 3C), even in older pupae. In *D. ater* the urogomphi (Fig. 3I) are also more curved anteriorly and are not straight. In most specimens examined there seem to be slightly more setae on the body, and the setae are somewhat finer and more slender.

Dermestes peruvianus Castelnau

DESCRIPTION

Adult

Previously described by Hinton (1945). Dark castaneous brown, clothed with short decumbent fulvous hairs. Integument somewhat more shiny than in *Dermestes maculatus*. Lateral impressed line on first sternite straight and parallel to lateral margin. Elytral apices entire, not serrate and also lacking sutural teeth. Length 6,6–11,0 mm.

Probably a native of South America and widely distributed through the major countries of the world (Hinton 1945). During surveys it was not found on the islands along the Cape coasts; however, it is almost as common as *D. maculatus* in carcasses and fish-meal accumulations around Cape Town.

Larva

Very similar to that of *D. maculatus* (see Fig. 2) in size, body form and setation, including the form of the spiracles; *D. peruvianus*, however, has pro-mesothoracic spiracle with more setae (about twelve) of equal size as in *D. ater*, and only first two abdominal spiracles are situated on a non-sclerotized membrane below sclerotized plates of the two segments (Fig. 5E); also transverse row of strong tubercles present on anterior border of sclerotized tergal plates on

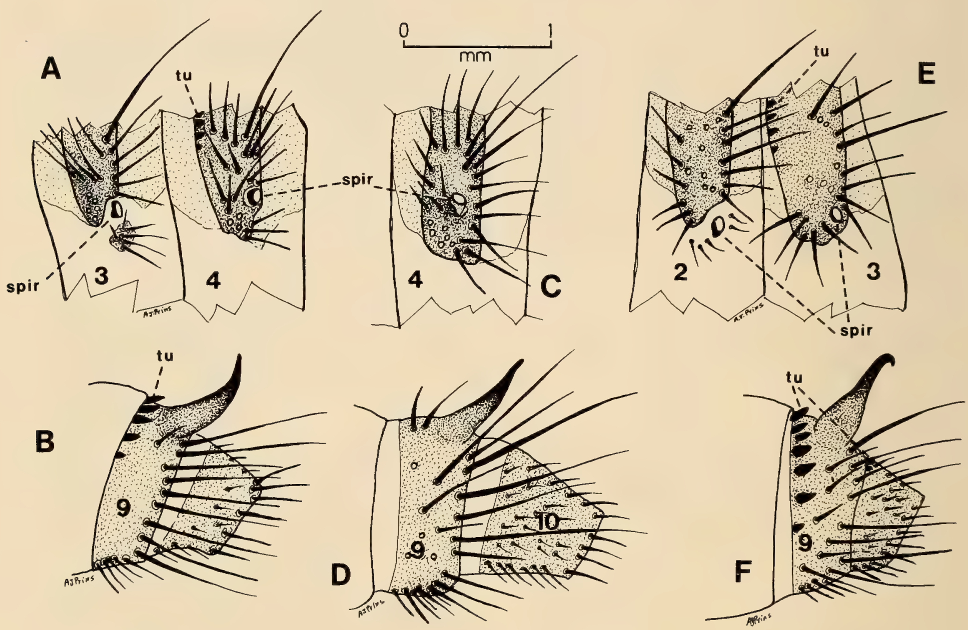

Fig. 5. Dermestidae. A. *Dermestes maculatus* larva, left lateral view of spiracles and tergal plates on segments 3 and 4. B. *Dermestes maculatus* larva, left lateral view of segments 9 and 10. C. *Dermestes ater* larva, left lateral view of spiracle and tergal plate on segment 4. D. *Dermestes ater* larva, left lateral view of segments 9 and 10. E. *Dermestes peruvianus* larva, left lateral view of spiracles and tergal plates of segments 2 and 3. F. *Dermestes peruvianus* larva, left lateral view of segments 9 and 10.

abdominal segments 3 to 10 (Fig. 5E–F). Urogomphi in this species (Fig. 5F) fairly straight, their apices curved caudally and downwards and, when seen from above, slightly divergent as in *D. ater*. Tarsungulus (Fig. 3N) with broad base, on each side with long slender ventral seta, tibiae with long slender posterodorsal preapical seta as in *D. maculatus*.

Head (Fig. 4K)

Very similar to that of *D. maculatus* (see Fig. 2E–F) in form, sclerotization and setation, including two tubercles on frontal area and distinct frontal and coronal sutures. Six ocelli on each side appearing somewhat smaller and arranged in two groups of three each. Antennae also similar to those of latter species, including sensory appendix, but in most specimens examined oval sensory spot placed on posteroventral side of second segment (in *D. maculatus* it is more ventral in position).

Labrum and clypeus

Very similar to those of *D. maculatus* including setation and labral emargination. *Epipharynx* (Fig. 4R) as in *D. maculatus* (see Fig. 2H) with proximal sensory area consisting of an anterior row of six large and a posterior row of about twelve minute papillae. Median setae about three to four in number in most specimens seen and rather broad, their apices either truncate or rounded, the setae somewhat broader than in *D. ater* and rather similar to those of *D. maculatus*.

Mandibles (Fig. 4L–M)

Very similar to those of *D. maculatus*, including broad retinaculum, rather narrow penicillus and transverse row of hairs near mandibular base; each demi-scrobe also with about four shorter setae. Apical tooth (t_1) the largest.

Maxillae (Fig. 4N, Q)

Similar to those of both *D. maculatus* and *D. ater* in form and setation, including maxillary palpi, forked spur on lacinia and hair brushes on both lacinia and galea. In this species there are also about three setae on subcardo.

Labium (Fig. 4O–P, S)

Very similar to that of *D. maculatus* including setal pattern and hypopharynx. Labial palpi also similar, but differ from those of both *D. maculatus* and *D. ater* by the first segment which bears at least two ventral setae.

Pupa

Similar to *D. maculatus* but the hair-bearing tubercles, particularly on the pronotum (Fig. 3D), although of about the same size, are more or less confined to the median area in *D. peruvianus*, and in the few specimens examined the hind margin of the mesonotum is more rounded in middle (in *D. maculatus* it is more pointed or rather acute). Urogomphi (Fig. 3H) more curved anteriorly as in *D. ater* and not straight as in *D. maculatus*.

SERIES ELATERIFORMIA

Family **Cantharidae**

Small to medium-sized, elongate, somewhat flattened leather-winged beetles, usually with reddish and bluish coloration. Head generally narrower than

pronotum and elytra, deflexed and with filiform antennae. Elytra covering the abdominal segments; tarsal formula 5–5–5. Luminous organs absent. According to Arnett (1963) they are in some ways the most primitive of beetles.

About fifty species have been recorded from southern Africa; their habits are largely unknown. Only one species of the genus *Afronycha* has been observed in animal dung during the surveys.

Afronycha picta (Wiedemann)

DESCRIPTION

Adult (Fig. 6A)

Dark olive green with orange-red head and pronotum marked with dark green. Dull, covered all over with fine, short greyish hairs. Legs orange red. Antennae usually dark; first two segments pale orange red. Length 9,1–11,6 mm.

Wittmer (1960) gives the distribution as Cape Town, Rondebosch, Camps Bay and Paarl. Delkeskamp (1977) mentions only Natal. According to collection data, however, it is widely distributed in the Cape Province.

Larva (Fig. 6B)

A general description of a cantharid larva is given by Peterson (1967). Full-grown larva of *Afronycha picta* measures 17–18 mm long and is velvety brown with somewhat bluish tinge on thoracic segments; each body segment with pale yellowish-brown marks and stripes and thin pale line on lateral margin. Tenth abdominal segment with small fleshy protuberance (Fig. 6L) acting as a proleg. Thoracic legs (Fig. 6J) well developed; claws (Fig. 6I) simple, long and acute, with two small spines near base on posterior side and one on anterior side. Each body segment with gland opening on each side. Spiracles (Fig. 6K) similar to that illustrated by Böving & Craighead (1931), opening almost circular with black, triangular area anteriorly, which, according to above authors, possibly represents the reduced air-tubes. Spiracular opening furnished with fine hairs. Cantharid larvae are campodeiform and orthosomatic.

Head (Fig. 6E)

Brownish with one well-developed ocellus on each side behind antenna. Subnasal sclerite sinuate on each side, with small tooth in middle. Epicranial halves fused ventrally. Antennae three-segmented; second segment about twice as long as first; third very small; second segment with a sensory appendix (Fig. 6F). Mandibles (Fig. 6G) almost falcate, nearly twice as long as wide, with two acute apical teeth; each mandible with a dorsal longitudinal row of fine hairs extending from preartis; lateral margin fairly strongly carinate; ventral side of teeth with conduit for juice. Mala (Fig. 6F, H) small and with long terminal hair. Mentum and stipes (Fig. 6F) clearly marked and fairly well sclerotized; prementum almost triangular. Maxillary palpi appearing four-segmented, but according to Peterson (1967) only three segments are present; apical segment about half as

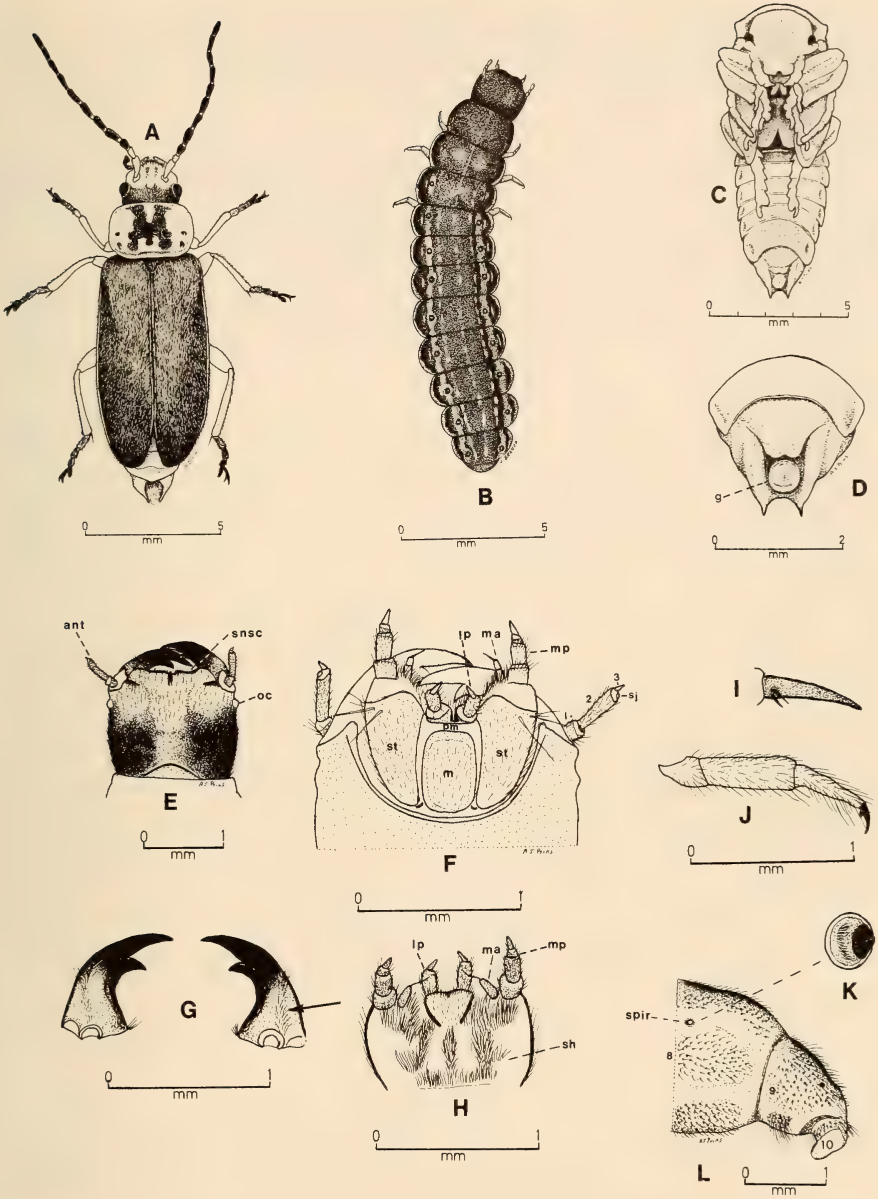

Fig. 6. Cantharidae. *Afronycha picta*. A. Adult. B. Larva, dorsal view. C. Pupa, ventral view. D. Detail of last segment of pupa, ventral view. E–L. Larva. E. Head, dorsal view. F. Head, ventral view showing mentum and stipes. G. Mandibles, dorsal view. H. Hypopharyngeal area, dorsal view to show straining hairs. I. Claw, enlarged to show spines. J. Right mesothoracic leg. K. Right abdominal spiracle to show triangular area and hairs. L. Apical abdominal segments, left lateral view.

wide as preapical one and tapering towards apex; the latter segment the shortest and ring-like. *Hypopharynx* (Fig. 6H) with at least three longitudinal rows of straining hairs.

Pupa (Fig. 6C)

Whitish yellow with reddish eye-spots and extreme apices of mandibles reddish. Specimens examined measure 10,1 mm long and 4,6 mm broad across widest part. Extreme apex of abdomen with two short spines or dents. Developing genital capsule (Fig. 6D) visible as large convex or rounded tubercle. As imago develops pupa becomes darker and apices of mandibles turn almost black; abdomen remains yellowish white and wing covers have piceous tinge.

BIOLOGY

Many species of cantharids are predacious, some feeding on aphids, others on the eggs of grasshoppers and on the larvae of Lepidoptera and Coleoptera; others again are phytophagous; some are omnivorous. The adult beetles often visit flowers where they feed on pollen. The larvae are free-living and predacious, preying on the larvae of other insects.

Young larvae of *Afronycha picta* were collected along the west coast of the Cape Province in fairly fresh as well as semi-fresh cow-pats during midwinter. These larvae are greenish in colour, dotted with tiny black and larger dark-grey spots. As they become older, the colour turns darker, until they assume their normal brownish-velvet appearance. Mature larvae were found in pats during August. They are fairly sluggish and feed on the coprophagous insects, including larvae of dung-flies (*Orthellia* spp.) and flesh-flies (*Sarcophaga* spp.). They have the habit of rolling around with the struggling prey until movement of the latter subsides, by which time half of the prey may have been devoured. The larvae were seen feeding on the juices oozing from wet dung.

The development of the larvae seems to be fairly slow and pupae were only recovered at the end of August and beginning of September from larvae collected in July. The pupal stages lasted about 11 days in the laboratory (19–22 °C); the beetles then emerged during September. In the Darling district they were also observed to emerge from cow-pats during May.

Family **Melyridae**

Small to medium-sized beetles, often with brilliant blue or red coloration, the head nearly as broad as pronotum and with serrate antennae. Elytra entire and tarsal formula 5–5–5 (rarely 4–5–5).

The Melyridae were previously regarded as a subfamily of the Dasytidae but have now been elevated to include the Malachiidae as well as the Dasytidae, the latter containing the most primitive living members of this group. Some authorities, such as Crowson (1952, 1964), regard the true position of this family to be in the superfamily Cleroidea and consider its resemblance to the family Cantharidae merely as a consequence of convergence. Melyrids most closely resemble can-

tharids both in structure and habits; however, the structure of the aedeagus of its members bears a clear resemblance to that of the superfamily Cucujoidea. Melyrid larvae on the other hand seem to be more closely related to the superfamily Cleroidea if certain characters such as the presence of a gular area, urogomphi and abdominal glands (also present in cantharids) are considered. However, the larvae are more free living and are either scavengers or feed on other insects, their larvae and eggs.

The adults are most probably carnivorous, although they are often found on flowers, where some feed on pollen. A few species are phytophagous such as the spotted maize-beetle, *Astylus atromaculatus* (Blanchard), a native of South America which is widespread in the Republic of South Africa. The adults of *A. atromaculatus* attack the flowers of maize, sorghum, etc., and are gregarious, accumulating in large numbers on the plants; it is also poisonous to cattle and sheep (Bedford *et al.* 1974).

A small metallic-blue and orange-coloured species, *Colpometopus basicornis* (Fairmaire), is common in stranded kelp and was also found to feed on the tissues of decaying animal carcasses on the beach, together with individuals of the larger *Melyris viridis*.

Melyris viridis Fabricius

DESCRIPTION

Adult (Fig. 7A)

Dull metallic green or sometimes with elytra coppery green. Each elytron with three distinct striae; whole insect dorsally covered with piliferous punctures. Hairs black and short. Pronotal disc on each side with longitudinal carina extending over anterior two-thirds and ending in raised frontal margin. Pronotum also with shallow, median, longitudinal impression, which is not very obvious in small specimens. Legs setose, lateral side of body fringed with short, fine, black hairs. Pronotum narrower than elytra. Length 9,6–13 mm.

Widely spread along the western and north-western coasts of the Cape Province.

Larva (Fig. 7B)

General description of a melyrid larva is given by Peterson (1967).

Melyris viridis larva subcylindrical, with nine visible abdominal terga; head small. About 19 mm long when fully grown and light brownish red in colour; vistiture consists of long, golden hairs. Prothoracic segment with broad, brown to blackish sclerotized shield, divided by thin, pale reddish, longitudinal (ecdysial) line. Meso- and metathoracic segments each with lateral brownish sclerotized area. Head, legs, and ninth abdominal tergum blackish; latter sclerotized dorsally and bearing two urogomphi which are curved upwards. Urogomphus with small tooth laterally, some distance from apex (Fig. 7G). Legs well developed, increasing in size from front to back; coxa, femur, and tibia well demarcated and furnished with long hairs; tarsungulus (Fig. 7F) moderately long, acute, and with

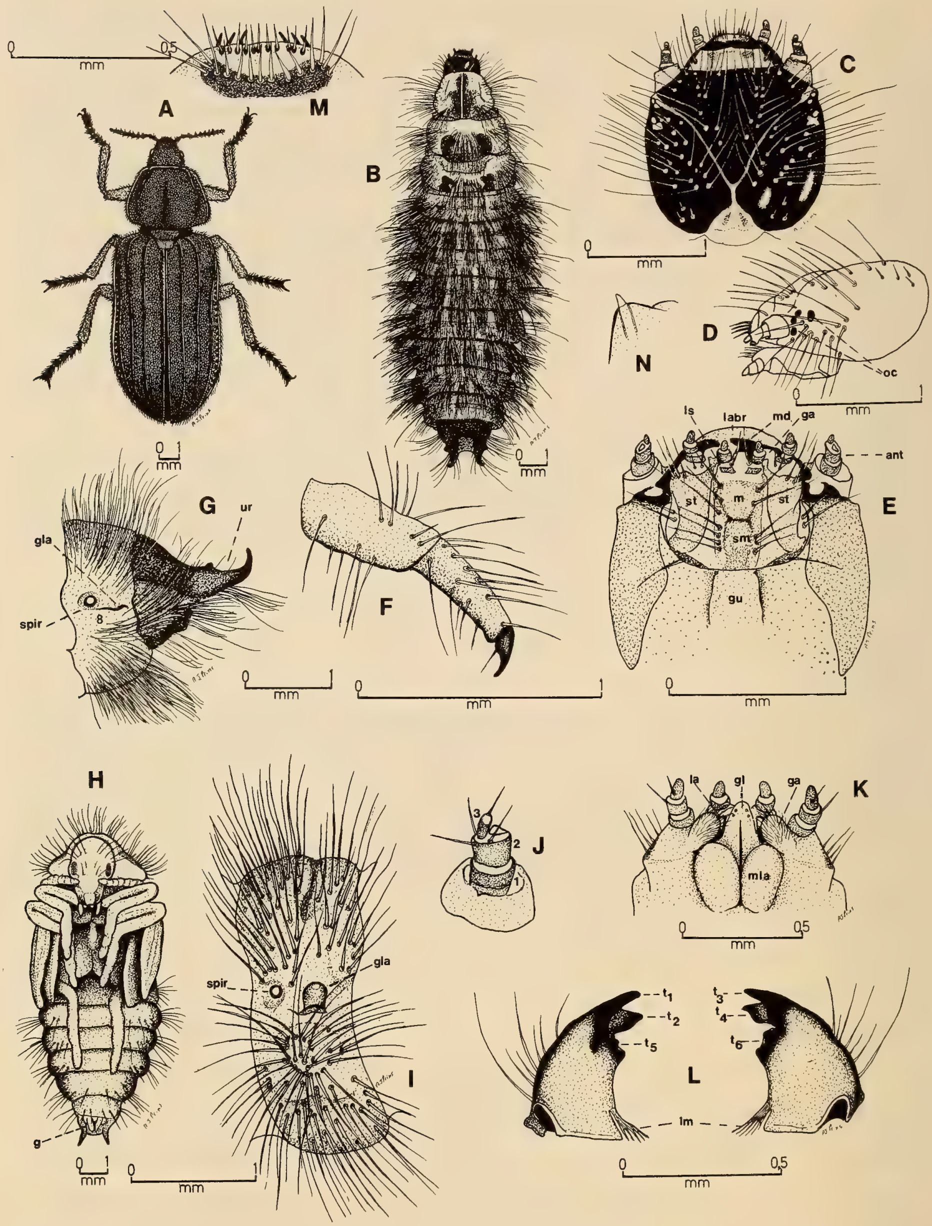

Fig. 7. Melyridae. *Melyris viridis*. A. Adult. B–G. Larva. B. Dorsal view. C. Head, dorsal view. D. Head, left lateral view to show ocelli. E. Mouth-parts, ventral view. F. Right mesothoracic leg. G. Eighth and ninth abdominal segments, left lateral view.
H. Pupa, ventral view. I–N. Larva. I. First abdominal segment to show the extruded defensive gland. J. Antenna. K. Maxillae and labium, dorsal view. L. Mandibles, dorsal view. M. Anterior part of labrum, dorsal view. N. Apex of lacinia showing tooth (highly magnified).

single long ventral seta on enlarged base. Two pairs of protrusible, lateral, defensive glands present (Fig. 7I); one pair on first and other pair on eighth abdominal segment; each gland normally indicated by narrow sclerotized slit just behind the spiracle (Fig. 7G). When larva is irritated, glands are evaginated. Crowson (1964) describes the same number of glands in *Astylus atromaculatus* and in *Melyris rufiventris* Boheman. Spiracles annular (Fig. 7I), small, and in most of the mature specimens examined opening is only 0,08 mm in diameter; the mesothoracic spiracle somewhat larger, measuring about 0,10 mm. Anus present as transverse slit, surrounded by single upper and double lower lip (divided by transverse furrow into two parts).

Head (Fig. 7C–E)

Slightly wider than long, black; epicranial suture Y-shaped and epicranial stem (coronal suture) well developed. Both frons and epicranium beset with long golden hairs. Four ocelli on each side, with posterior one largest. Antennae (Fig. 7J) three-segmented, first two segments somewhat compressed laterally and retractable into antennal base; third segment small, with single medium-long seta and some sensory pegs at apex. Second antennal segment with triangular raised area ventrally near apex; also with three medium-long apical setae of which two are lateral and one dorsal in position. Gula clearly demarcated and about as wide as or slightly wider than labium.

Small larvae, only 6,0 mm long, showed same characteristics as mature ones, except for smaller number of setae on labrum.

Labrum and clypeus

Both well developed; labrum about as long as clypeus, and almost semicircular in specimens seen. It bears median transverse row of long setae as well as second transverse row of shorter setae near extreme anterior margin, each seta placed on a small black sclerotized area (Fig. 7M). Ventral side of labrum with six strong palus-like setae close to anterior margin (clearly seen in Fig. 7M). In most specimens seen, epipharynx bears six large papillae, medially arranged in two rows; four in anterior and two in posterior one; also two small papillae posterior to latter row. Clypeus with only single long seta on each side.

Mandibles (Fig. 7L)

Slightly longer than wide; fairly broad and robust in dorsal view. Dorsal carinae almost absent, mandibles rounded dorsoventrally in this area; however, very weak oblique scrobis present with eight or ten setae, of which proximal one is longest. Stridulatory areas absent; prostheca well developed and situated near the base. True molar area absent, cutting edge broad and almost quadridentate in most specimens. Fairly acute apical (t_1 and t_3) and preapical teeth (t_2 and t_4) are present, latter situated ventrally; proximal teeth (t_5 and t_6) smaller, dorsally situated, usually slightly bidentate and apparently functioning as molar area. Portion of cutting edge between ventral and dorsal teeth shallowly excavated.

Maxillae (Fig. 7E)

Short, galea and lacinia united and almost inseparable. According to Böving & Craighead (1931) lacinia has no spurs in Melyridae. However, apex of lacinia is angular with minute tooth connected to internal tube (Fig. 7N), visible only under high magnification. Galea globular, with large number of fine setae on dorsal side, but ventrally devoid of hairs; two long ventral setae, however, present just posterior to palpal bases. No unci observed. Maxillary palp three-segmented; second segment with lateral and third segment with dorsal seta as well as some sensory pegs. Cardo transverse and with single long seta. Stipes long and clearly demarcated ventrally, with about six long setae apically and two basal setae; dorsally devoid of setae.

Labium (Fig. 7E, K)

Submentum and mentum (apparently the first and second prementum of Anderson (1936)) fairly distinct; the former with three to five long setae on each side, the latter with two to three setae. Prementum of labium visible as two sclerites, each with a single seta; labial palpi two-segmented; gula convex. Glossa (or ligula) pointed, with four sensory spots. Basally two swollen lobes may represent superlinguae of hypopharynx.

Pupa (Fig. 7H)

Dark reddish with whitish antennae, legs, and elytra. Whole body abundantly covered with long golden-brown hairs, particularly on dorsal side. Body has bluish violaceous shine and after few days two brownish eyes become visible. The developing genital capsule present as two short conical projections; extreme apex also with two short, fleshy protuberances. Length 10,5–12,9 mm.

BIOLOGY

Adult beetles of *Melyris viridis* were collected on the beaches and foredune system along the west coast of the Cape Province from Kommetjie to Elands Bay, almost throughout the year. They feed on the pollen of flowers of *Arctotheca populifolia* and *Tetragonia decumbens* and were seen to copulate in large numbers during midwinter (June) and also during the early summer (November) when peak emergence occurred during the surveys. They are attracted to decaying carcasses and cow-dung and were often observed to nibble holes in the leaves and flowers of the above-mentioned plants.

Fully developed eggs dissected from adults in August were brownish red, oval, and varied in size from 0,8 by 0,44 mm to 1,42 by 0,64 mm; they were almost shiny and very superficially reticulate. The eggs are apparently laid during the winter, the mature larvae burrowing into the sand from September to November; eggs that were laid during the summer gave rise to full-grown larvae during the winter. Some of the larvae kept under observation passed the summer in sheltered spots in the sand or under dry kelp, and even under dry cow-pats, and pupated the following April, the beetles then emerging in June. These larvae are

therefore present on the beach for the greater part of the year, except possibly for a short period during the winter and again during the summer. Observations made during 1976 indicated that there were two generations per year with overlapping of adults and larvae. Pupation took place 50–100 mm deep in the sand under plants growing on the upper boundary of the beaches. During mid-summer full-grown larvae and beetles can often be found about 15 cm deep in the sand below plants growing on the beach.

The larvae are omnivorous and feed on semi-dry parts of decaying kelp, partly dry cow-dung, decaying red-bait (*Pyura stolonifera* (Heller)), bird and other animal carcasses, as well as on leaves and flowers of such plants as *Arctotheca populifolia* and certain vygies, and even on vegetables, such as pumpkins, thrown on the beaches. When resting in the sand they were seen to feed on the beach-fleas, *Talorchestia australis* Barnard and *T. capensis* Dana.

SERIES CUCUJIFORMIA

Family **Tenebrionidae**

Small to fairly large, almost round to elongate beetles, varying from white to brown or black, sometimes even with reddish marks. The prognathous head is narrower than pronotum, elytra usually covering the abdomen and often with striae. Tarsal formula 5–5–4.

According to Watt (1974) the primitive forms are relatively large and both larval and adult life is usually long. It is one of the largest families of the Coleoptera, the largest forms occurring in the genus *Psammodes*, measuring up to 60 mm in length. Most of them are adapted to resist desiccation and they are therefore well represented in arid or semi-arid areas and may occur almost anywhere, including birds' nests; however, they are apparently not adapted to living in water.

The adults generally feed on dead vegetable and sometimes also on animal matter. The larvae of most species, however, will feed on living plant tissues—particularly under adverse conditions. When crowding occurs the larvae of most species become cannibalistic. Wings are well developed in the smaller species, particularly the stored-food pests such as the lesser meal-worm, *Alphitobius diaperinus* (Panzer), the common meal-worm, *Tenebrio molitor* Linnaeus, the horned flour-beetles, *Gnathocerus* spp., the confused and rust-red flour-beetles, *Tribolium confusum* du Val and *T. castaneum* (Herbst), the dark flour-beetle *T. destructor* Uyttenboogaart, the long-headed flour-beetle *Latheticus oryzae* (Waterhouse) as well as in the dusty surface-beetles *Gonocephalum* spp. The psammophilous members and toktokkies (*Psammodes* spp.) on the other hand are apterous. Some tenebrionid beetles are able to protect themselves by secretions from defensive glands.

Psammodes species, particularly *P. granulatus* Solier, were common on the sand-dune system together with *Zophosis acuta* Wiedemann. The latter is an endemic southern Cape dune species, which was also occasionally attracted to

decaying kelp on the beach, most probably because of the high water content of the seaweeds, as these insects seem to favour damp substances; *Z. acuta* often appeared under semi-dry cow-dung some distance from the shore.

An unidentified small, black, ant-like tenebrionid, *Herpiscius* sp. (Fig. 8K), with glabrous elytra was very common in debris on the small foredunes skirting the beaches along the west coast. The larvae feed on the roots of the dune plants, and the white pupae (Fig. 8L) were usually found in the loose sand during the summer and early autumn. One often sees these beetles running on beds in houses and rondavels of holiday-makers near the beach, where they are generally mistaken for ants or small spiders. Further away from the coast, they have been found to visit dry cow-pats during the warm months, probably for the shelter provided by the hard crust of the dung.

In Zimbabwe the matt, dark-brown to blackish *Herpiscius sommeri* Solier, which, according to collection data, is widely distributed in the Cape Province, was found to occur in large numbers among the stilt roots of the young maize plants. It is rather similar to the previously mentioned unidentified species of *Herpiscius*, but is easily distinguished by the distinct longitudinal striae on the elytra. *Herpiscius sommeri* beetles were responsible for the destruction of the anchor roots, causing severe damage to the maize plants (Rose 1964). Other tenebrionids common in the debris under the loose sand on the dunes were species of *Phaleriderma* and *Gonopus*, but their habits are unknown.

Dry cow-pats, particularly those that are fairly large, provide shelter for a variety of tenebrionids, especially in open veld. The most common species found during the surveys were the dusty surface-beetles, *Gonocephalum arenarium* (Fabricius) and *G. simplex* (Fabricius), both of which occurred during the late summer and winter months in most of the areas visited, often in association with *Blenosia exarata* (Quensel), a dull-blackish beetle endemic to the Cape.

At least four species of mouldy beetles (subfamily Eurychorinae) were collected under dry pats, of which the widely distributed *Eurychora ciliata* (Fabricius) is the largest, measuring 13–14 mm in length. *Lycanthropa plana* Haag, 6–7 mm in length, is more brownish and is endemic. Specimens of *L. plana* which are indistinguishable from *L. litoralis* Koch were collected near Saldanha, and may indicate that the existence of *L. litoralis* as a species as suggested by Koch (pers. comm.) may not be valid. These beetles were all very plentiful along the west coast. The genus *Geophanus*, another member of this subfamily, was represented by a rather small, unidentified, black species (4–5 mm long). Although rather scarce, it occurred in the same localities as the other members of this group.

Trachynotus reticulatus (de Geer) is blackish, elongate, 13–14 mm long, and is characterized by a strong carina on each elytron. It was observed in association with two other black forms, viz. *T. acuminatus* Quensel and an unidentified molurine species; both of the latter species lack the rugosity of *T. reticulatus*. Several *Psammodes* species were also found in greater abundance, but the common ones were rarely seen under cow-pats. However, one large unidentified toktokkie, about 20 mm long, occurred in the Karoo during the summer and autumn months.

The genus *Hologenosis*, which is rather similar to the previously mentioned genus *Zophosis*, was represented by a dull-black, unidentified species of about 5,8 mm long; it was found to be quite common in the Karoo. A dorsoventrally flattened, dark-brown species of *Blastarnus* (near *pruinosis* Fairmaire), with seven to eight longitudinal carinae on the elytra, occurred together with the species of *Hologenosis*. The related *Emyon* sp. (near *brunnipes* (Erichson)) found with them, resembles a snout-beetle and is dark, castaneous brown, and of about the same length as the *Hologenosis* sp.

The black, long-legged *Stenocara dentata* (Fabricius) (about 13 mm long) occurred in the vicinity of Calitzdorp under dry pats devoid of any other insects. Its body is covered with small tubercles and the shiny longitudinal costae on the elytra are also tuberculate. The related *S. longipes* (Olivier) of about the same size, its body with larger tubercles and lacking true costae, is another very common species in the western Cape Province. It occurs under dry and even semi-fresh cow-pats, often in association with the smaller and shiny, dark-brown *Ograbies subdentatus* Koch and the dull dark-grey *Asida unigena* Peringuey, both of which are endemic to the Cape. From observations it seems that under certain circumstances these beetles feed on the damp particles of the dung. This also seems to be true in the case of the shiny black *Eutochia pulla* (Erichson), which is very similar to *Alphitobius diaperinus* (Fig. 11D), and which is widely distributed in the Subsaharan region. *Eutochia pulla* may, however, be easily distinguished from *A. diaperinus* by its somewhat longer, almost moniliform antennae, better-developed striae on the elytra, and by the posterior margin of the pronotum, which is less sinuate on each side.

At least two greyish species of *Cryptochile*, both marked with brown patches and also characterized by two strong carinae on each elytron, were found under semi-dry to fresh cow-pats in the western parts of the Cape Province. They were accompanied by a small, black species of *Horatoma*, whose presence was probably coincidental, and occasionally by a dull-black meracanthine, *Acanthomera dentipes* (Fabricius).

The masses of stranded kelp on the intertidal and supratidal zones attracted very few tenebrionids apart from the already mentioned *Gonocephalum arenarium* and *Zophosis acuta*, and the pale psammochromic *Pachyphaleria capensis* (Castelnau), which feeds in both the adult and larval form on the stipe and fronds of the large *Ecklonia maxima*, and probably also on *Laminaria pallida* and *Macrocystis angustifolia*. According to Griffiths and Stenton-Dozey (pers. comm.) this last-mentioned beetle forms one of the most important elements of individual kelp strings.

Gonocephalum arenarium (Fabricius)

DESCRIPTION

Adult (Fig. 8A)

Dull, dark-brown to blackish species, covered with yellowish-brown to greyish-brown adpressed hairs giving it a dark-greyish appearance. The two

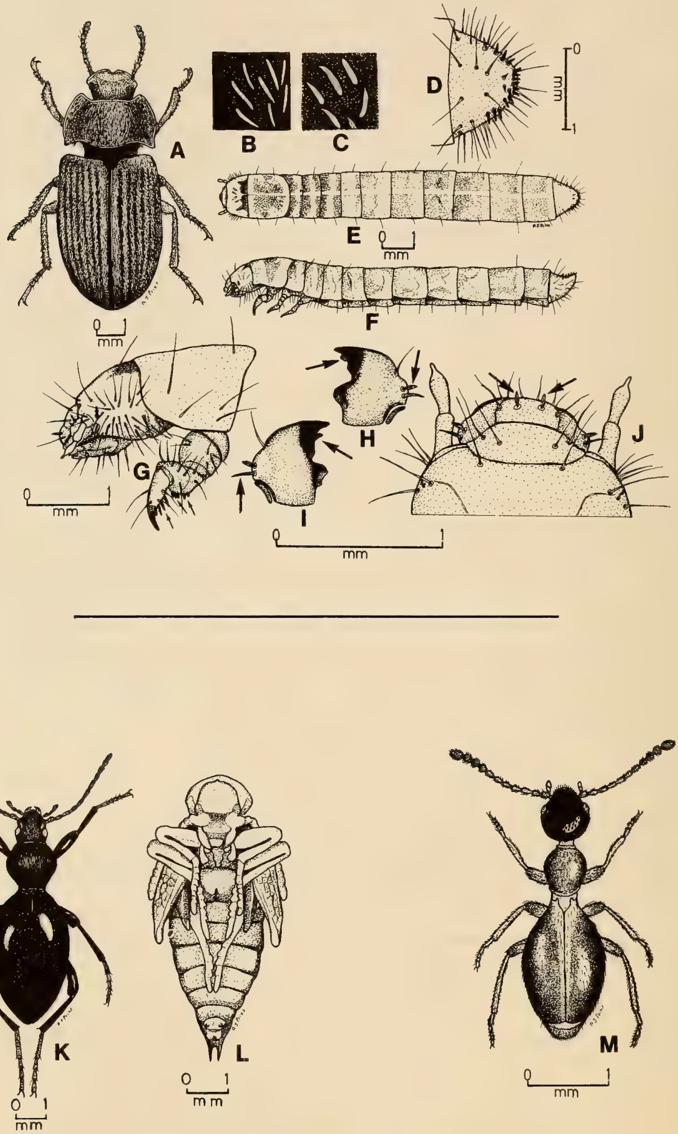

Fig. 8. Tenebrionidae, Anthicidae. A–B. *Gonocephalum arenarium* adult. A. Dorsal view. B. Body setae enlarged. C. *Gonocephalum simplex* adult, body setae enlarged. D–J. *Gonocephalum arenarium* larva. D. Apical abdominal segment, dorsal view. E. Larva, dorsal view. F. Larva, left lateral view. G. Head and first leg, left lateral view. H. Right mandible, dorsal view. I. Left mandible, dorsal view. J. Front part of head, dorsal view. K–L. *Herpiscius* sp. K. Adult. L. Pupa, ventral view. M. *Anthicus apterus*, adult.

species *Gonocephalum arenarium* and *G. simplex* (both found under cow-pats in the western Cape) can be separated by the structure of the body hairs (Fig. 8B–C), those of *G. simplex* being flattened, almost scale-like.

According to collection data in the South African Museum *G. arenarium* is widely distributed in the Cape, South West Africa, east Africa, and is also present on some of the islands along the Cape coast.

Larva (Fig. 8E–F)

Full-grown larvae are about 16 mm long and pale, yellowish red in colour; young specimens usually with pale, yellowish-white, longitudinal line over dorsum of body. Claws simple, acute and rounded on dorsal side, but almost flat ventrally and bordered on each side by a trenchant ridge, which extends nearly from apex to base; spine at this point present on each side, posterior one rounded and broad, other one longer and pointed. Front legs much more strongly developed than others. Mandibles (Fig. 8H–I) broad, only slightly longer than wide, and clearly divided into cutting and molar areas; former longer in left mandible; each cutting edge with preapical ventral tooth. Both molar areas pointed distally when seen from above. Each mandible with lateral carina running from extreme apex almost to middle, with long seta at this point on lateral face; also with dorsal carina which is fairly rounded longitudinally and bearing two spines dorsally; anterior spine short and rounded, posterior one longer and pointed. There are also two short spines placed medially on labrum of *G. arenarium* (Fig. 8J), which Jack (1918) does not record in *G. simplex*.

Jack (1918) describes the larva of *G. simplex* and it appears to be very similar to *G. arenarium*, possessing almost the same number of spines on the ventral side of the front legs (Fig. 8G) and thirteen to twenty-one spines on the anal segment (Fig. 8D). They differ, however, in that *G. arenarium* has one small basal spine or strong seta (or two in some cases) laterally on each pseudopod, which, according to Jack, is absent in *G. simplex*.

BIOLOGY

The dusty surface-beetles are polyphagous and may attack both roots and stems of various wild plants and vegetables. The larvae of *G. arenarium* have been collected during October to December on the foredune system feeding on the roots of the dune plants, the adult beetles emerging during January. The beetles were found to feed on the leaves and stems of *Arctotheca populifolia* along the west coast, causing feeding marks similar to those made by boring caterpillars. Adults of this species were also observed under stranded kelp along the west coast, just above the high-water mark.

Gonocephalum arenarium, together with the dull-black scarab, *Trox horridus* Fabricius, was collected by members of the Percy FitzPatrick Institute of African Ornithology of the University of Cape Town during their surveys on Malgas and Marcus islands near Saldanha as well as on Dassen Island. Although they describe the vegetation on Marcus Island as being rather sparse and

G. arenarium is usually associated with plants, the material brought to the islands by cormorants for nesting purposes may fulfil this beetle's needs.

Pachyphaleria capensis (Castelnau)

DESCRIPTION

Adult (Fig. 9A)

Oval, pale straw-coloured to pale yellow. Some specimens with darker patch in middle of elytra; head somewhat darker, in some specimens piceous. Finely punctured, sparsely on elytra; latter with about seven weakly developed striae each, smooth and fairly shiny. Pronotum on each side just in front of hind margin with small, somewhat oblique impression. Length 6,6–7,5 mm.

Widely distributed along the Cape coasts and collected as far north as South West Africa.

Larva (Fig. 9B–C)

Subcylindrical or somewhat flattened; 13–16 mm long when fully grown, pale straw yellow with darker or brownish patches on dorsum. Latter divided by distinct ecdysial suture, which is fairly clearly visible over first four to six abdominal segments. Pronotum somewhat larger than other segments. Sparsely covered with fine golden-brown hairs. Ninth abdominal segment (Fig. 9D–E) somewhat wider than long, rounded in dorsal view, excavated in middle and bearing six to eight strong, short spines on posterior border, which is slightly emarginate in some specimens. Four long setae present dorsally near anterior margin. Pygopodia small. Abdominal spiracles circular, those on first segment slightly larger than others, usually visible on ventral side. Mesothoracic spiracle oval, larger than those on abdomen. Apart from medium-long and shorter spine-like setae, integument is covered with minute spines, only visible under high magnification (Fig. 9G). Legs (Fig. 9F) well developed, with reduced number of spines; those on prothorax somewhat stronger; tarsungulus of each leg simple and acute and with single ventral and posterolateral spine near base.

Head (Fig. 9H, J–K)

Cranium nearly twice as wide as long, with sides fairly convex and somewhat emarginate. Brownish yellow to straw yellow in colour; frontal and coronal sutures fairly distinct, frontoclypeal suture well demarcated. Very minutely reticulate and fairly shiny, sparsely punctate, the punctures shallow; chaetotaxy as illustrated. Hind margin ventrally deeply emarginate in middle; postgenae separated by poorly demarcated gula. Neck absent. Antennae (Fig. 9I) tubular, second segment somewhat longer than first and wider distally, bearing some minute setae apically; third segment small, much shorter than second and bearing long seta apically as well as two or three smaller ones. Five darkly pigmented, almost black ocelli present laterally, appearing as one eye when seen from above.

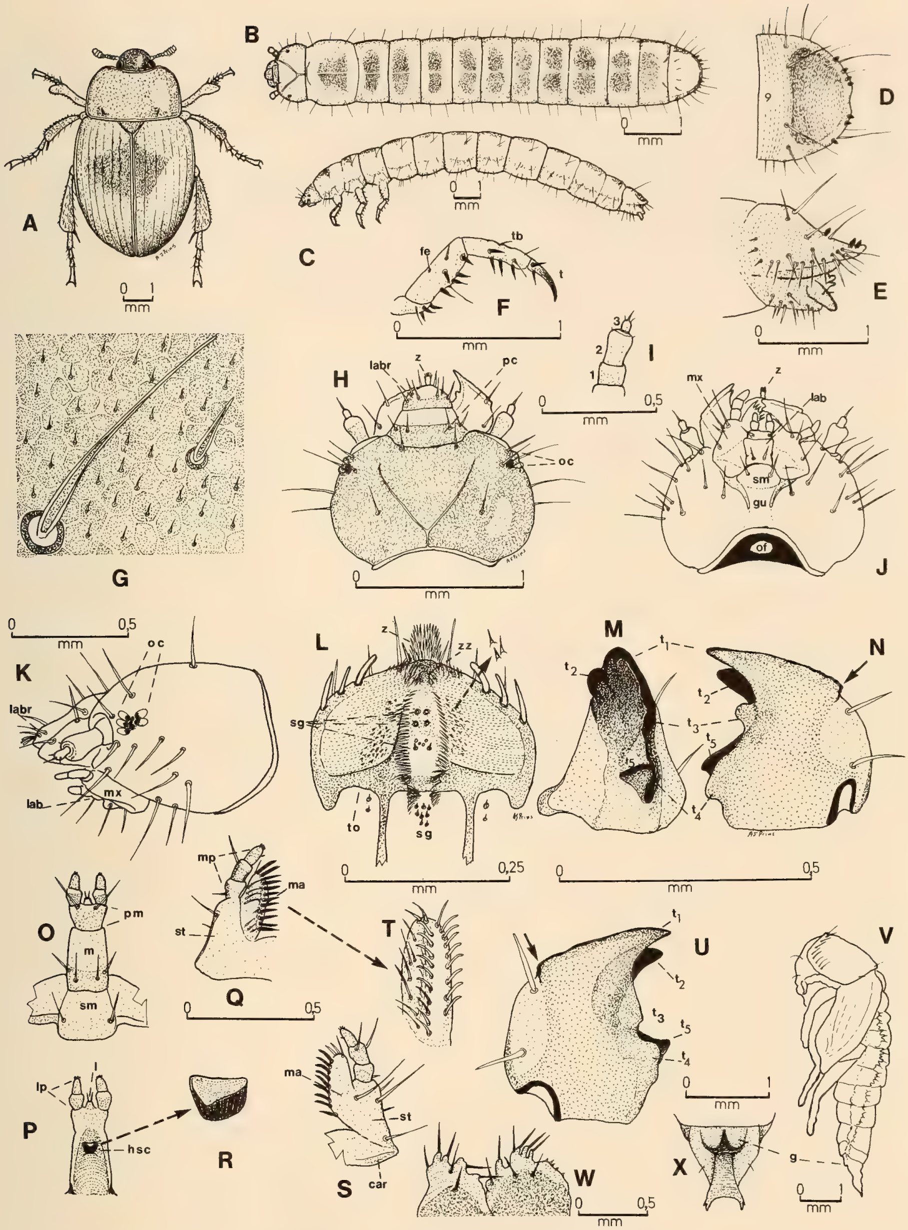

Fig. 9. Tenebrionidae. *Pachyphaleria capensis*. A. Adult. B–U. Larva. B. Dorsal view. C. Left lateral view. D. Ninth abdominal segment, dorsal view. E. Ninth abdominal segment, left lateral view. F. Right mesothoracic leg. G. Integument, highly magnified. H. Head, dorsal view. I. Antenna. J. Head, ventral view. K. Head, left lateral view. L. Epipharynx. M. Right mandible, cephalic view. N. Right mandible, dorsal view. O. Labium, ventral view. P. Hypopharynx. Q. Left maxilla, dorsal view. R. Hypopharyngeal sclerite enlarged. S. Left maxilla, ventral view. T. Mala of left maxilla, cephalic view. U. Left mandible, dorsal view. V–X. Pupa. V. Left lateral view. W. Comb-like structure on first and second abdominal segments. X. Apex, ventral view.

Labrum and clypeus

Labrum free, with anterior margin very rounded or convex and bearing six strong spine-like setae dorsally, as well as three smaller setae on each side on anterior margin. Clypeus almost trapezoidal and with four setae on stronger sclerotized postclypeus.

Epipharynx (Fig. 9L). Tormae symmetrical; posterolateral processes short and triangular median ones long and slender; the anterolateral extensions present seem to be better developed and longer on right side, furnished with fine hairs which form oval patch on each side of raised oblong central disc; the hairs on each side extending on to central posterior area behind which are eight small spines or sensilla; fine setae also extending on to anterior part (zz), forming a fairly large brush (z) on anterior margin, also visible dorsally. Central disc with four large anterior and four smaller posterior sensilla, as well as two short spines posterior to these. Laterad of each posterior tormal process two spines present in most specimens examined. lateral margin anteriorly with three strong sickle-shaped or lanceolate spines of which front one is apically rounded and somewhat more strongly developed.

Mandibles (Fig. 9M–N, U)

Similar to those of *Gonocephalum arenarium* (Fig. 8H–I). Broad, left mandible slightly longer than wide, right one about as wide as long. Cutting edge bidentate, lower tooth (t_2) more rounded in some specimens; upper one (t_1) acute when seen from the dorsal side. Upper tooth (t_1) on each mandible extended dorsolaterally as trenchant ridge almost to molar area; latter with broad almost rounded tooth (t_4) dorsally and also extended ventrally as broad tooth (t_5); whole forming an almost triangular ridge on both mandibles (Fig. 9M). On right mandible an extra rounded tooth (t_3) present dorsally about half-way between apex and molar area; on left one only an indication of this tooth present. Lateral margin has a break at about middle, lateral face sloping down from this break, with weaker sclerotization and bearing two strong dorsal setae.

Maxillae (Fig. 9Q, S–T)

Mala fairly broad, tapering to apex, with some fine, long hairs dorsally in two longitudinal rows next to spines and some near lateral margin. Mesal margin with two rows of spines or spine-like setae, curved at their tips, about twelve in dorsal and nine in ventral row. Stipes ventrally with three long setae and two shorter setae on lateral side, of which distal one is largest. Maxillary palp three-segmented, with first two segments of about equal length, apical one shortest and with about twenty sensory pegs at apex and minute seta in about middle on mesal side; second segment with one ventral and one lateral seta, and some minute spines near apex; first segment also with minute spines near apex and short seta on external lateral margin near base. Cardo without setae.

Labium (Fig. 9O)

Submentum somewhat trapezoidal, with two long setae. Mentum long, almost barrel-shaped or even tubular in some, with four setae. Prementum with two setae. Ligula short, about half the length of first palpal segment and bearing two apical setae and some minute spines on dorsal side. Palp two-segmented, with segments of about equal length; apical one with about twenty sensory pegs at apex; first segment with minute dorsal spines and a tiny lateral seta at base in most specimens examined.

Hypopharynx (Fig. 9P, R) medially raised and convex from side to side and conical, hypopharyngeal sclerite as short, broad, truncate tooth, almost triangular in some specimens.

Pupa (Fig. 9V–X)

Whitish at first, but becoming yellowish later; about 6 mm long. Row of fine golden setae present on front margin of pronotum, extending along anterior part of lateral margin. About four setae present on head. 'Gin-traps' absent from median area of abdominal dorsum, but each segment with lateral comb-like extension (Fig. 9W) bearing four to six setae. Number of setae and fleshy protuberances diminishing posteriorly. First seven pairs of spiracles clearly visible laterally in fold formed by comb-like extensions; first two pairs of spiracles close together and more or less covered by wings; eighth pair inconspicuous. Extreme apex (Fig. 9X) has appearance of flat lobe, widening posteriorly, with two spines on each corner, lateral ones shortest. Developing genital capsule takes shape of two swellings; in some with extra projection of about same length laterad of each conical swelling.

BIOLOGY

Pachyphaleria capensis beetles are found on the beach all the year round and feed on decaying and fresh kelp. In areas where kelp is scarce they become scavengers and feed on animal or bird carcasses on the beach. They were found in wet sand under kelp at a depth of 150 to almost 300 mm. Larvae of this species were collected along the west coast of the Cape Province during the autumn and early winter and feed mostly on the fresh parts of washed-up kelp. When confined to a small space or when food becomes scarce they become cannibalistic. As in the case of the beetles, the larvae will feed on bird carcasses when kelp is not available. There is a short prepupal stage of 2–4 days. Pupae are found in loose or hollowed-out chambers in the damp sand and are usually hooked to the remains of the larval skin. In the laboratory, pupal stages lasted about 16 days during May.

Tribolium destructor Uyttenboogaart

DESCRIPTION

Adult (Fig. 10A)

Dark-brown to piceous-brown, elongate beetle, 3,9–5,3 mm long. Head and pronotum fairly densely punctured; punctures large and oval; elytra each with

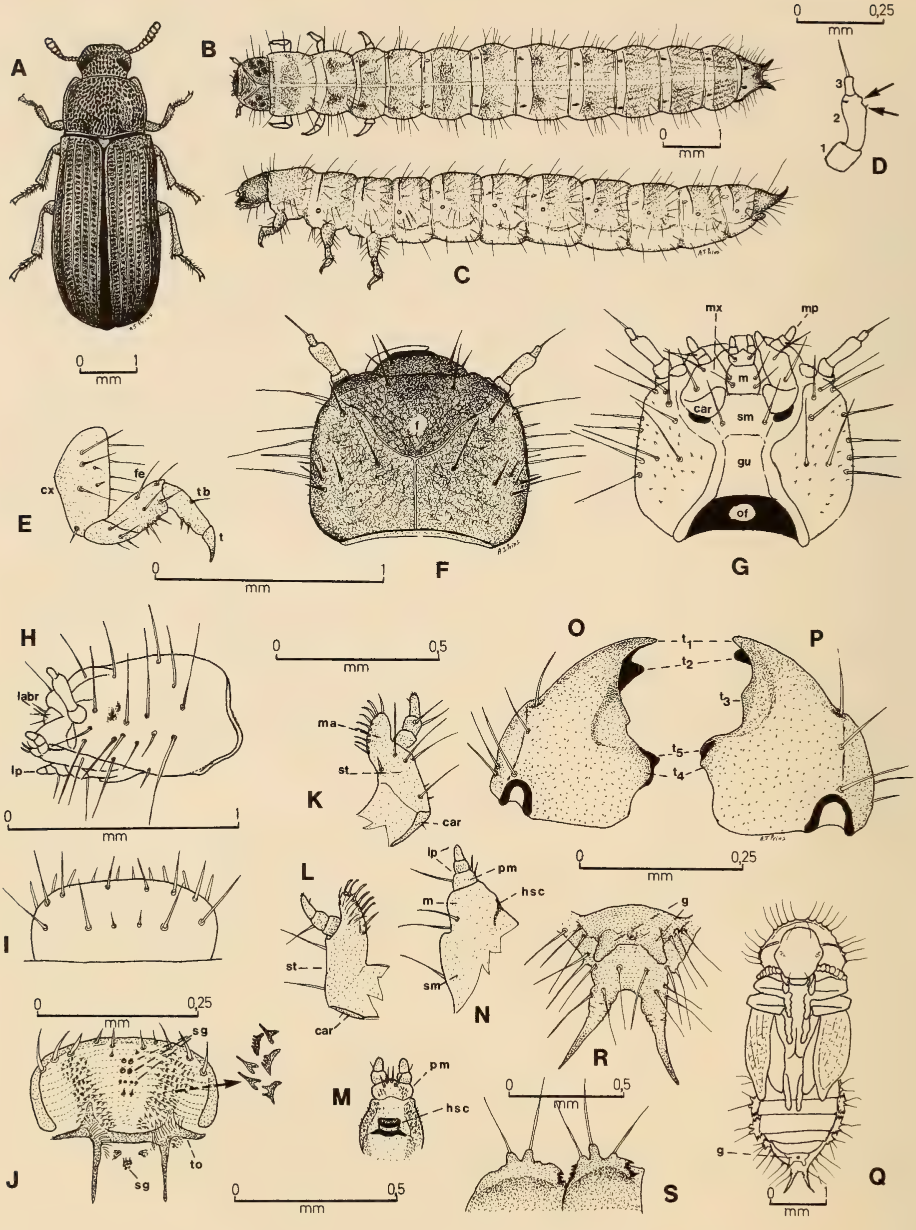

Fig. 10. Tenebrionidae. *Tribolium destructor*. A. Adult. B–P. Larva. B. Dorsal view. C. Left lateral view. D. Antenna. E. Right mesothoracic leg. F. Head, dorsal view. G. Head, ventral view. H. Head, left lateral view. I. Labrum, dorsal view. J. Epipharynx. K. Left maxilla, ventral view. L. Left maxilla, dorsal view. M. Hypopharynx. N. Labium, left lateral view. O. Left mandible, dorsal view. P. Right mandible, dorsal view. Q–S. Pupa. Q. Ventral view. R. Abdominal apex, ventral view. S. Comb-like structure on first two abdominal segments.

nine to ten longitudinal striae and with row of large shallow punctures between striae, lateral ones more conspicuous; area between punctures very finely reticulate and whole insect therefore fairly shiny. Only legs and antennae covered with fine yellowish-brown hairs.

Tribolium destructor belongs to the *confusum*-group (Hinton, 1948), but may easily be distinguished by its larger size and the fact that the narrowest part of the eye, where it is divided by a carina on the side of the head, is usually as broad as two facets of the eye, and the frons is beset with punctures that are as long as the eye facets. In *T. confusum*, the narrowest part of the eye is no broader than one facet.

This species is widely distributed in the Republic of South Africa according to collection data and often appears in stores and butcheries in the western Cape. It is a native of Africa and is also a pest in North America (Hinton 1948).

Larva (Fig. 10B–C)

General body colour creamy white or whitish yellow, most segments brown dorsally; the head, thoracic and last two abdominal segments darker. Ecdysial suture distinct. Length 9.5–10 mm when fully grown. Body subcylindrical to almost cylindrical and sparsely covered with long golden setae, more or less arranged in two rows on each segment. Urogomphi short, acute, divergent and directed upwards. Spiracles circular, visible laterally; mesothoracic pair very slightly larger than others. The pygopodia can be retracted into the ventral aperture of the ninth segment.

Legs (Fig. 10E) well developed, all of about equal length and with a reduced number of setae. Tarsungulus acute, simple, without spines and slightly shorter than length of tibia. Dorsal integument very similar to that of *Pachyphaleria capensis*, with long setae and short spines, but lacking minute spicules.

Head (Fig. 10F–H)

Cranium only slightly wider than long, minutely reticulate, only slightly shiny and also somewhat rugulose, particularly the frons. Frontoclypeal suture well developed; frontal and epicranial sutures inadequately indicated. Antennae (Fig. 10D) three-segmented, second segment about twice as long as first, with small sensory tubercle on anteroventral side as well as at least one or two minute spines below it and one situated dorsolaterally; third segment small, about as long as first, with a medium long apical seta. One or two pigmented eye-spots visible behind antennal base, but separate ocelli not demarcated in specimens examined. Postgenae ventrally separated by fairly wide gula. Neck absent. Setation as illustrated; some setae very long. Head capsule, particularly side and ventral part, with numerous small spines.

Labrum and clypeus

Labrum (Fig. 10I), which is partly concealed by clypeus when viewed from above, is characteristic of this species. Clypeus about three times wider than long.

its anterior margin almost straight or slightly concave in most specimens seen and bearing two medium-long setae on each side. Labrum much shorter than clypeus and slightly more than twice wider than long; setal pattern as illustrated.

Epipharynx (Fig. 10J). Under high magnification four large sensory spots or cones visible on raised median area and just posterior to these a transverse row of four minute sensory cones present, as well as two small spines. Most specimens examined also with two large sensory cones near anterior margin, just posterior to paramedian setae. Setation of each side of median area consists of minute spicules, which are either simple or with two to four teeth. Tormae symmetrical, on each side with oblique row of fine hairs as well as two sensory cones and group of eight tiny sensory spots or spines between posterior arms. Anterior margin with four short setae and three large almost sickle-shaped setae posterior to these on each side.

Mandibles (Fig. 10O–P)

Somewhat longer than wide, with break on lateral margin not so obvious as in *Pachyphaleria capensis*. Each mandible with two setae situated on short, oblique rounded dorsal carina, as well as one long anterior and two posterior setae on lateral face; latter setae situated ventrally near base. The median tooth (t_3) on right mandible much less pronounced than in *P. capensis*.

Maxillae (Fig. 10K–L)

Mala devoid of setae on ventral side, except one spine-like seta near base in some specimens; dorsally, however, with some long hairs and mesal margin with two rows of spines, seven to ten on each side (as in *P. capensis*). Stipes with three long ventral setae, one seta on lateral side near palpifer and about two short setae near cardo; dorsally devoid of setae. Cardo without setae, except for one or two very short ones in some specimens. Maxillary palp three-segmented; segments short; first two nearly of equal length; the second with one lateral and one ventral seta; apical segment somewhat longer and with some sensory cones at apex and minute seta on mesal margin some distance from apex.

Labium and hypopharynx (Fig. 10M–N)

Similar to that of *P. capensis* (including ventral setae), but ligula absent and mentum shorter. Hypopharyngeal sclerite is more oval, appearing cup-shaped and in most specimens examined with roughly M-shaped sclerotized band or base posterior to it. Glossa with four setae between and posterior to two-segmented palps. Surface of glossa and area around hypopharyngeal sclerite covered with minute spines. In lateral view submentum is raised above level of mentum. Labial palp with apical segment somewhat longer than first and with seta on external margin near base.

Pupa (Figs 10Q–S, 12B)

Length about 5 mm; at first pale or whitish except for apical spines, which are brownish or yellowish. It gradually darkens in colour and just before imago

emerges it becomes piceous. The pupa of *Tribolium destructor* is rather similar to that of *P. capensis* (see Fig. 9V–X), but is more elongate, with somewhat more hairs on the body, particularly on abdomen. It differs from the latter by smaller size and longer apical spines. Developing genital capsule (Fig. 10R) takes shape of two fairly long diverging, conical projections, which in the case of *P. capensis* are placed more parallel. Lateral extensions of abdominal segments (Fig. 10S) each with two conical tubercles and two to three setae (at least three to four in *P. capensis*); anterior and posterior teeth strongly developed. Spiracles similar to those of *P. capensis*.

BIOLOGY

Larvae of *Tribolium destructor* were collected during September in butcheries around Paarl and Wellington in sawdust sweepings containing small bits of meat and dust. Their life-span was fairly long, at least 4–6 months, and pupae formed during October to December produced beetles after 12–23 days. During the winter months the pupal stage was somewhat longer. In most cases pupation occurred in the sawdust mixture without the construction of pupal cells.

The newly-emerged beetles have yellowish-white elytra, with pale yellowish-brown head, thorax and legs. After a day or two they become castaneous brown and may remain pale coloured for up to 8 days, after which they attain their normal piceous or brownish-black colour.

Alphitobius diaperinus (Panzer)

DESCRIPTION

Adult (Fig. 11D)

Blackish-brown to almost black, shiny, slightly oval beetle, whole dorsal surface of head and pronotum finely punctured; each elytron with about six weakly developed, longitudinal, punctured striae with some punctures in between striae. Hind margin of pronotum sinuate on each side, antennae short, about as long as length of pronotum, incrassate towards apex. Legs short. Length about 6 mm.

Cosmopolitan (Andres 1931; Cotton 1941) and commonly found in South Africa.

Larva (Fig. 11A)

Subcylindrical and very similar to that of *Pachyphaleria capensis* (see Fig. 9B), creamy white, with brownish coloration on tergal plates, ecdysial suture as thin whitish line along middle of dorsum, only faintly visible on second to last abdominal segments in most specimens seen. Pronotum somewhat larger than other segments as in latter species; whole body sparsely covered with fine golden hairs. Ninth abdominal segment (Fig. 11B) convex, triangular when seen from above; apex ending in an upcurled spine; laterally and dorsally with about sixteen spine-like setae, also with some long slender setae, particularly on ventral side; dorsally also four long setae in transverse row in about middle of segment.

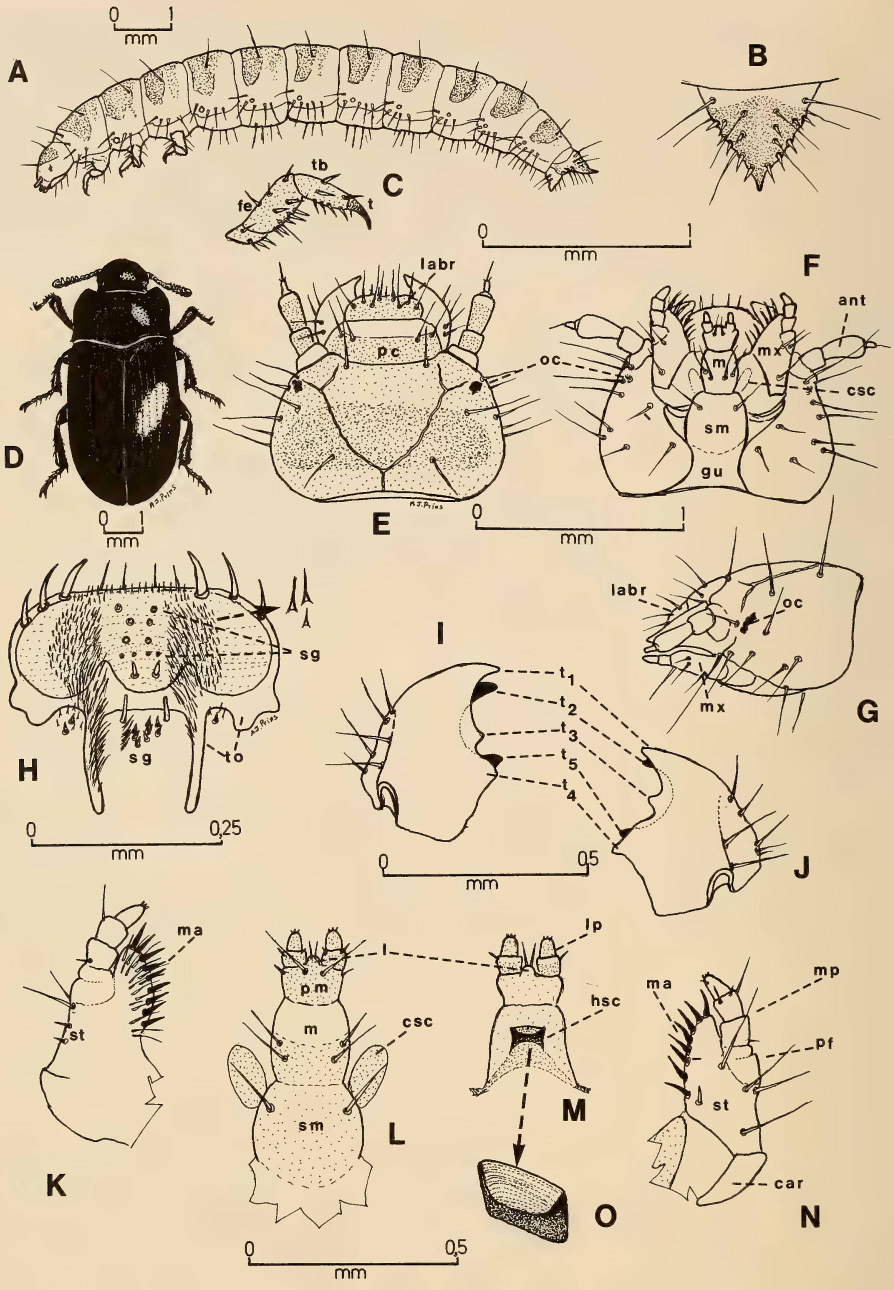

Fig. 11. Tenebrionidae. *Alphitobius diaperinus*. A–C. Larva. A. Left lateral view. B. Ninth abdominal segment, dorsal view. C. Right mesothoracic leg. D. Adult. E–O. Larva. E. Head, dorsal view. F. Head, ventral view. G. Head, left lateral view. H. Epipharynx. I. Left mandible, dorsal view. J. Right mandible, dorsal view. K. Left maxilla, dorsal view. L. Labium, ventral view. M. Hypopharynx. N. Left maxilla, ventral view. O. Hypopharyngeal sclerite, highly magnified.

Pygopodia fairly well developed and usually seen as two conical processes below ninth segment. Spiracles circular, that on mesothorax the largest; first abdominal spiracle also somewhat larger than other abdominal spiracles. Legs (Fig. 11C) well developed, of about equal size and with reduced number of spines and setae; tarsungulus simple, fairly long, acute and with single ventral seta. Dorsal integument as in *P. capensis*, including the short spines and spicules. Length about 11 mm when fully grown.

Head (Fig. 11E–G)

Cranium nearly twice as wide as long, sides convex; shiny, somewhat shagreened, golden yellow; central transverse area darker, almost reddish brown in some specimens, including clypeus and labrum. Mandibles lighter in colour than rest of head. Coronal and frontal sutures clearly indicated, latter branched near antennal bases (apparently also the case in *Pachyphaleria capensis* and *Tribolium destructor*, but not as distinct as in this species). An elongate blackish eye-spot present behind antennal bases, but individual ocelli not demarcated in all specimens examined. Chaetotaxy as illustrated. Hind margin dorsally and ventrally only slightly emarginate in middle, postgenae separated by fairly well-indicated gula. Antennae as in *P. capensis*, second segment about one-third longer than first; third segment also small, less than one-third the length of second and bearing long apical seta.

Labrum and clypeus

Labrum about twice as wide as long and somewhat narrower than clypeus, its front margin almost straight, lateral margins convex. About ten slender setae present of which two are situated on central area and two in middle near anterior margin; also four short setae present along front margin. Clypeus as in *P. capensis*, slightly less than twice as long as labrum, with four setae on postclypeus.

Epipharynx (Fig. 11H). Rather similar to that of *T. destructor* (see Fig. 10J). Tormae symmetrical, posterolateral processes short and broad, median ones long and slender. Fine spine-like setae cover most of elongate area on each side of raised central part and forming an almost single row along front margin, the setae longer on tormae and along each side of central part, which bears six large sensilla and transverse posterior row of four smaller ones; behind these two spines present; also two longer spines or teeth present between posterior arms of tormae near transverse central bar, and just behind right tooth a row of about six longer spinules (or setae). Eight spines (or sensory spots) present on central area just behind long posterior teeth as well as one on left side between posterolateral process and median arms, and two in same position on right side. Three sickle-shaped setae present on each lateral margin of which the distal one is more strongly developed than others (rather similar to those of *P. capensis*).

Mandibles (Fig. 11I–J)

Similar to those of *P. capensis* (see Fig. 9M–N, U), fairly broad with flattened, almost triangular lateral face, bearing about six slender setae on its

upper and lower margins as indicated in drawing. Cutting edge bidentate on both mandibles with lower tooth (t_2) smaller than upper or apical one. Molar area with upper tooth (t_4) rounded on left mandible, but more acute on right one. Lower molar tooth (t_5) fairly acute on both mandibles. A small, distinct, rather acute tooth (t_3) present on trenchant ridge from upper scissorial to upper molar tooth, close to latter on left, but in about middle on right mandible (in both *P. capensis* and *T. destructor* this tooth is almost obsolete in left mandible).

Maxillae (Fig. 11K, N)

Similar to those of *P. capensis*, broad, mala with double longitudinal row of about nine spines on mesal side, dorsally beset with fine slender setae; ventrally devoid of slender setae. Stipes ventrally with three long setae of which one is situated near base, just anterior to cardo, which is fairly well indicated and without setae. Also small spine or spine-like seta present near mesal margin; dorsally stipes without setae, except one long and two short setae placed somewhat dorsolaterally. Maxillary palpi three-segmented, first two segments of about equal length, apical one somewhat shorter and with short subapical seta on mesal side and about twenty sensory pegs on apex; first segment with short dorsolateral seta near base and second segment with two very short ventral setae and one long lateral seta near apical border. Palpifer without setae and forming small, almost ring-like segment at apex (not observed in the specimens of the other two previously mentioned species).

Labium (Fig. 11L–M)

Submentum broad, oval, with two setae, one on each side near base of oval convex sclerite of cardo. Mentum longer than wide, somewhat barrel-shaped, its sides convex and bearing four setae on sclerotized posterior part. Prementum shorter than mentum with two long median setae near apex and short seta placed ventrolaterally; also minute spines posterolaterad of each median long seta. Glossa without setae as in *P. capensis*, ligula short, about three-quarters the length of first palpal segment and with two setae at apex. Labial palp two-segmented, first segment broader than long and somewhat longer than apical conical segment and with two short ventral setae near apical border one mesally and one laterally; second segment with about twenty sensory pegs at apex.

Hypopharynx (Fig. 11M, O). Medially raised, the hypopharyngeal sclerite appearing cup-shaped; however, when viewed slightly from the side its dorsal aspect is an almost inverted horseshoe-shaped sclerite with a somewhat dome-shaped ventral side.

Pupa (Fig. 12A, C–D)

Rather similar to that of *Tribolium destructor* (see Fig. 10Q–R) but larger, measuring 6,6 mm long and 2,7 mm broad and lacking the long setae on pronotum; latter broad, about twice as wide as long (in *T. destructor* only slightly wider than long). Head, pronotum, wing-covers and pleural surfaces with some

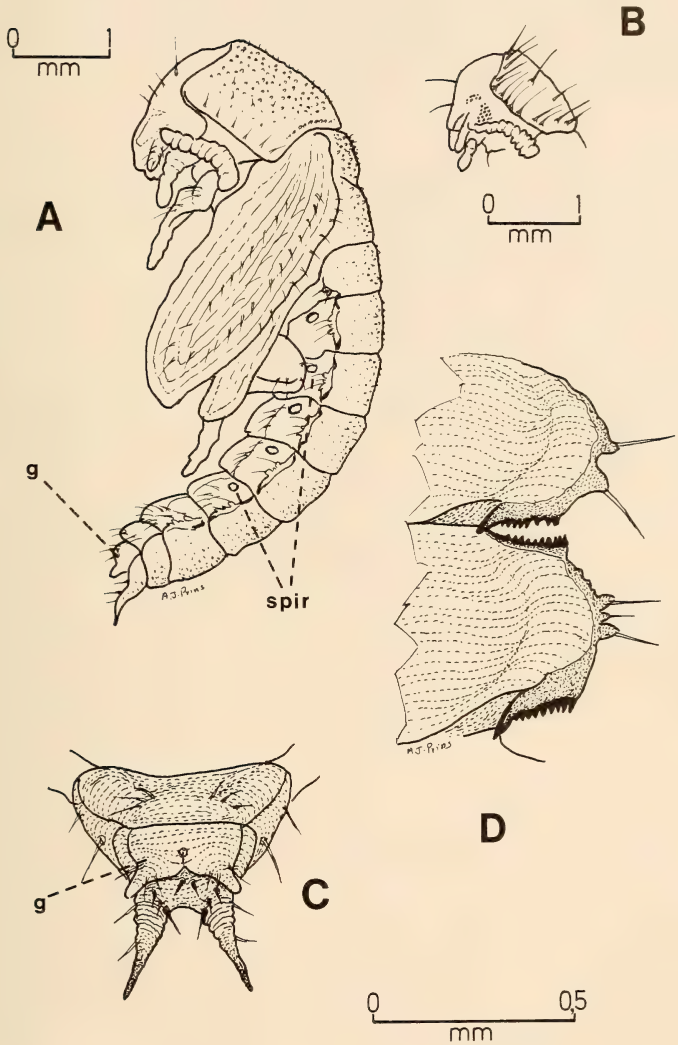

Fig. 12. Tenebrionidae. A. Pupa of *Alphitobius diaperinus*, left lateral view. B. Head and pronotum of pupa of *Tribolium destructor*, left lateral view. C–D. Pupa of *Alphitobius diaperinus*. C. Abdominal apex, ventral view. D. Comb-like structures on first two abdominal segments, dorsal view.

fine setae, also some setae present on legs and mandibles. Thorax and abdominal terga covered with minute tubercles, those on thorax larger than the others (in *T. destructor* the body surface is more shagreened or wrinkled). Spiracles similar to those of *T. destructor* and *P. capensis*, six pairs clearly visible, seventh pair indistinct. Developing genital capsule and lateral extensions of abdominal terga including anterior and posterior teeth similar to those of *T. destructor*; however, the dentate areas more elongate.

BIOLOGY

The genus *Alphitobius* belongs to the subfamily Ulominae, the members of which are mostly detritivorous. Only about ten species of this genus occur in the Subsaharan region, one, *A. leleupi* Koch, being commonly found in the nests of gerbilles (*Tatera* species—Koch 1953). As far as is known only four members have been recorded from southern Africa, viz. *A. hobohmi* Koch from South West Africa, *A. karrooensis* Koch from the Cape Province, *A. ulomoides* sensu Koch (nec *ulomoides* Solier, which is a native of Chile), and the widespread *A. diaperinus*, which has become a pest of stored grain and flour. However, according to Cotton (1941) it does not damage sound and dry grain. There is also a possibility that this latter species plays a role in the transmission of acute leukosis in chickens (Eidson *et al.* 1965).

The lesser meal-worm *A. diaperinus* often occurs, together with skin-and-hide beetles, during the third or dermatophagous stage of decay of carcasses and cadavers and is commonly found in fowl manure, particularly in the closed-type poultry batteries with a fairly high and constant temperature of about 20 °C. Where very large populations of this beetle and of *Dermestes maculatus* occur the beetles compete with the normal fly species to such an extent that such poultry houses are almost free of the common house-flies, false stable-flies and lesser house-flies. Under these circumstances larvae of the skin-beetle may become troublesome in their effort to secure suitable space for pupation and may cause severe damage to roof timbers, door frames, etc. Application of an insecticide such as carbaryl in a broad band around the inside walls and the floor adjoining the walls of the building has controlled the wandering larvae of this pest in the past, whilst allowing the meal-worm larvae to continue feeding in the manure; however, large populations of the latter may have a depressing effect on hens kept on floor litter. When crowding occurs in the case of large populations larvae of both species become predacious and even cannibalistic. Young larvae are preyed upon by the histerid *Carcinops minuta* (Fåhraeus), breeding in the manure.

Fairly young larvae of the lesser meal-worm collected on a decaying turtle carcass during February lived for at least 30–40 days in the laboratory and moulted several times before pupation occurred; the pupal stages lasted for about 10 days (temperature about 25 °C). According to Barké & Davis (1969) the pupal stadium was 7–11 days at about 21 °C and 70 per cent relative humidity, and the total life-cycle 69–91 days; the eggs hatched over a period of 6–10 days. Cornwell

(1973) gives the minimum development period as 40 days at 25 °C. When freshly formed, the pupae are creamy white but later change to a darker colour. The newly-emerged beetles are pale brownish-white and assume their normal colour in a day or two.

SERIES SCARABAEIFORMIA

Family **Scarabaeidae**

Small to large, usually stout-bodied or robust beetles, sombre to brightly coloured with partly deflexed head and antennae with lamellate club of three to seven segments; elytra usually exposing pygidium; wings well developed, absent in some forms such as certain dung-rollers and trogids (the latter often regarded as a separate family, Trogidae). Head and pronotum often with horn-like processes; front tibiae fossorial; tarsal formula 5–5–5.

This is a large family composed of two groups. In the first at least four subfamilies are involved and the members are either saprophagous or fungivorous. This group includes the true dung-beetles or dung-rollers of the subfamily Scarabaeinae (Coprinae) in which the adults have eight- to nine-segmented antennae and the larvae have a distinct dorsal hump (Fig. 19C). Their legs are usually reduced or the claws are absent. Both adults and larvae are found in dung and carrion and the adults may even feed on fungi. This subfamily includes fairly large and robust beetles, having a body length of up to 57 mm in Subsaharan forms, such as *Heliocopris gigas* (Olivier), ranging from Zimbabwe to tropical Africa. It also includes the flightless, ball-rolling *Circellium bacchus* (Fabricius), which has been recorded from the Cape Province, Transvaal, and Mozambique (Ferreira 1967) but according to Tribe (1978) is now restricted to the eastern Cape Province, particularly the Addo Elephant Park, and may be heading for extinction. It is most probably a forest-bound species and may still be present in fair numbers in such localities in Mozambique, Transvaal, and the north-eastern parts of southern Africa.

Some of the smaller members of this subfamily such as the widely distributed, bronze-and-green dung-beetle, *Onitis aygulus* (Fabricius), and the black *O. caffer* Boheman do not roll balls but burrow into the soil beneath animal droppings and utilize the contents below the crust of the cow-pats for oviposition. These are strong fliers and powerful diggers and prefer fresh dung, particularly during the winter months.

Three species of the smaller genus *Euoniticellus* were collected from fresh dung during the surveys: *E. intermedius* (Reiche), *E. triangulatus* (Harold) and *E. africanus* (Harold), of which the first two occurred in large numbers almost throughout the year in most of the areas visited. The indigenous *E. africanus* (Fig. 14F) was only occasionally encountered, usually in the Montagu area and along the south coast during the summer and late spring. These beetles are dark brown with black marks and spots on their bodies, and vary in length from 7–10 mm in *E. intermedius* and *E. triangulatus* to 10–11 mm in *E. africanus*.

Oniticellus pictus (Hausmann) (Fig. 18A) and *O. planatus* Castelnau (Fig. 19A) also visit fresh dung, as their pupal cells were often found in large numbers in semi-fresh pats in the Robinson Pass and near Mossel Bay during the autumn. *Oniticellus pictus* resembles the members of the genus *Euoniticellus*, but is easily separated from them by the clearly demarcated black marks on its body. Both *O. pictus* and *O. planatus* were found in the same pats.

Chironitis scabrosus (Fabricius) was very common near Montagu and in the Karoo during the summer. This beetle is medium-sized, castaneous or testaceous brown with a bronzy tinge, having the pronotum with irregular rugae and the elytra with blackish tubercles. In fresh cow-pats it was usually associated with *C. hoplosternus* (Harold), which is rather similar, but has the pronotum somewhat wider, is more greenish and is without the rugosity.

The black species of *Copris* and *Onthophagus* were observed in small numbers on fresh dung in various localities during the spring and winter, *Copris anceus* Olivier (Fig. 13A) being the most common. Males of *C. anceus* (19–20 mm long) have a triangular horn on the head; females, which are somewhat smaller, have the pronotum slightly convex, without horns and the head with only a short tooth-like horn.

Onthophagus minutus Hausmann (about 6 mm long), black in colour, with a short tooth-like horn on the head of the male, was occasionally seen feeding on fresh and semi-fresh dung near Mamre and other Sandveld areas. Another species, *O. immundus* Boheman (matt black and 5–5,8 mm long), was frequently found in Heidelberg during the spring and summer. The males are easily recognized by two parallel horns on the head. In this area it was associated with the much larger (9–12,6 mm) *O. binodis* Thunberg (Fig. 14A–B), also matt black. Males of the latter have a rectangular, carinated, raised lobe in the middle of the pronotum. This species also occurred commonly in the Karoo during the autumn. *Onthophagus cameloides* D'Orbigny (Fig. 13E), dull black and about 10 mm long, appeared in partly dry dung in the western and northern parts of the Cape Province, but was not numerous.

A rather peculiar, dark-brown scarab, *Drepanocerus kirbyi* Kirby (Fig. 14D), about 6 mm long with three long horns, one on the head and two on the pronotum, seems to be fairly common in the Robinson Pass where it was found feeding on fresh dung on several occasions during the summer and autumn months. The large, shiny black dung-roller, *Neateuchus proboscideus* (Guérin) (Fig. 14G) (almost 30 mm long), on the other hand, was collected only occasionally during the spring in the north-western parts. Other small scarabs belonging to this subfamily, found in fresh to semi-fresh cow-pats, were the greenish-black *Epirinus aeneus* (Wiedemann) and the larger, blackish *E. flagellatus* (Fabricius) (Fig. 13D), both endemic to the Cape according to collection data.

The small dung-beetles of the subfamily Aphodiinae include the regular inhabitants of herbivore droppings that never bury any dung but feed on it as long as enough food is available. The larvae of these coprophagous beetles with their

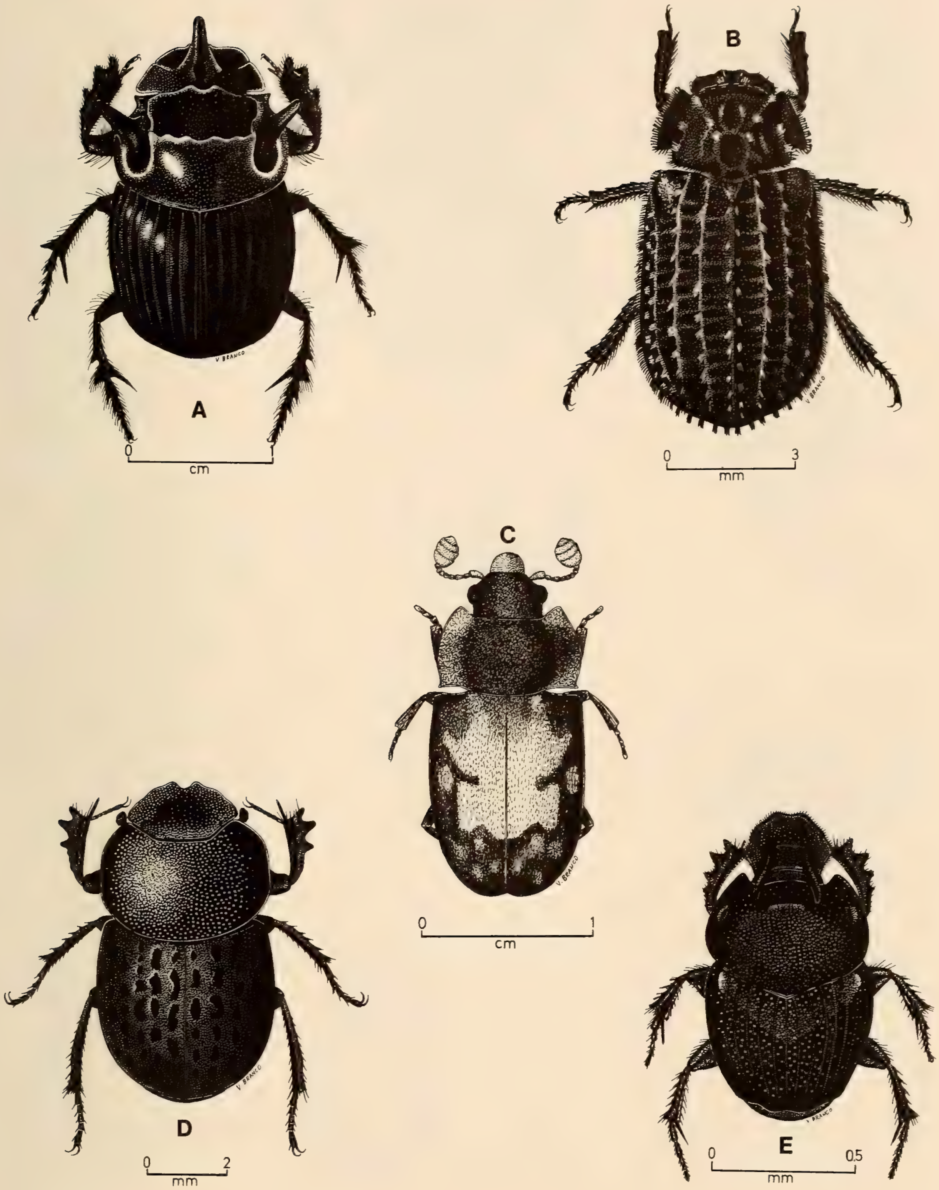

Fig. 13. Scarabaeidae. A. *Copris anceus*. B. *Trox fascicularis*. C. Unidentified species of Trogositidae. D. *Epirinus flagellatus*. E. *Onthophagus cameloides*.

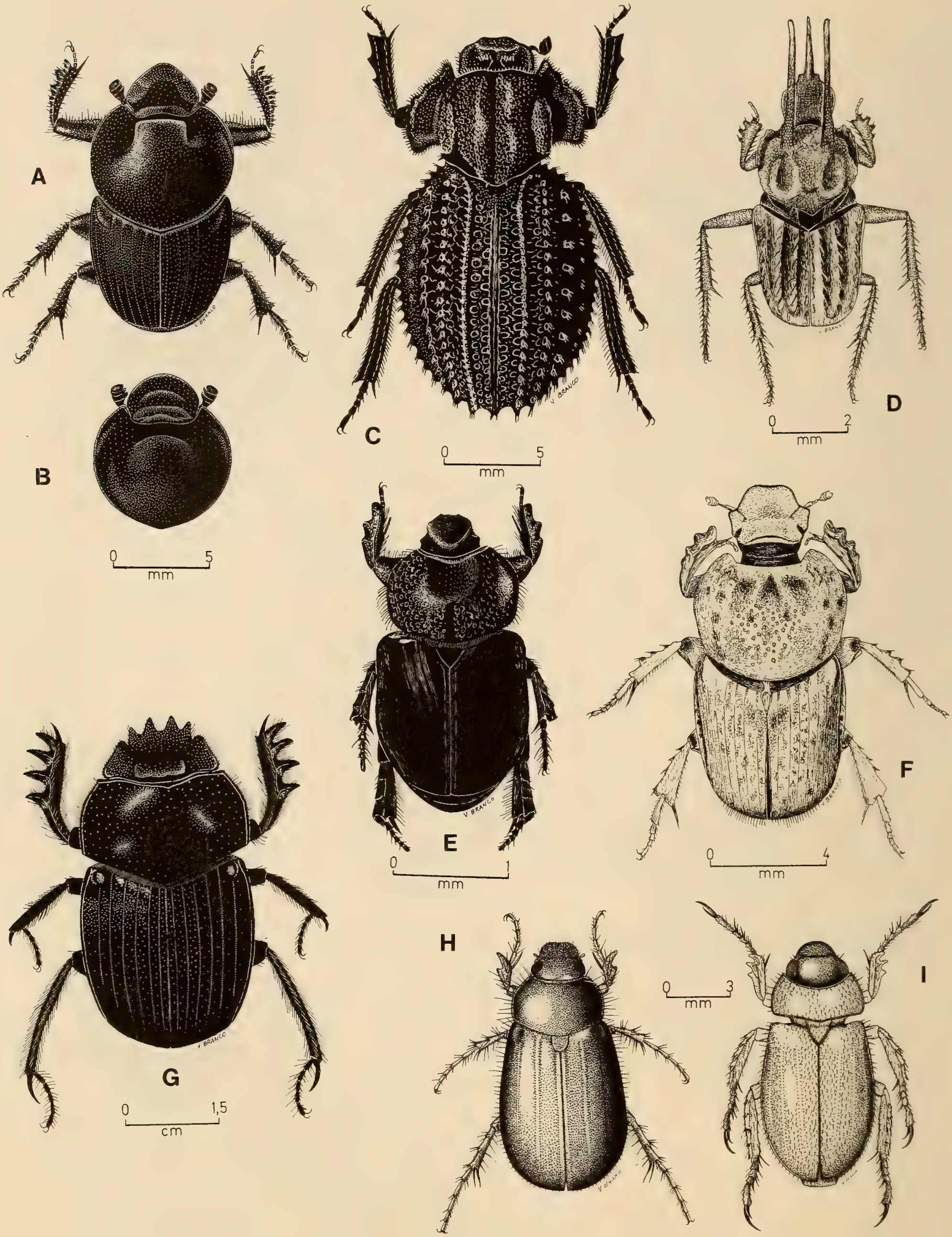

Fig. 14. Scarabaeidae. A. *Onthophagus binodis*, ♂. B. *Onthophagus binodis*, head and pronotum of ♀. C. *Trox horridus*. D. *Drepanocerus kirbyi*. E. *Temnorrhynchus retusus*. F. *Euoniticellus africanus*. G. *Neateuchus proboscideus*. H. *Eucamenta castanea*. I. *Adoretus ictericus*.

well-developed mouth-parts are able to feed on even fairly dry dung particles, whereas in the case of the adults, as in other smaller members such as the previously mentioned genus *Oniticellus*, the mouth-parts are more membraneous and they are therefore compelled to feed on moist or soft dung. This is also substantiated by their intestinal contents which generally only contain soft liquid compounds.

In the adults the antennae are usually nine-segmented with three-segmented club and the larvae have well-developed legs and lack the dorsal hump. A few species are phytophagous (not present in South Africa) and at least two species, *Aphodius lividus* (Olivier) and *A. granarius* (Linnaeus) (both present in South Africa), are cosmopolitan.

Some 150 species of aphodiines have been recorded from southern Africa of which about ninety-six belong to the genus *Aphodius*. These small scarabs are rather important as they play a vital role in the disposal of animal dung in the veld. During the surveys at least ten species were found to be attracted to fresh droppings, and some used the dung as food. *Aphodius procerus* Harold, *A. consimilis* Boheman and *A. laetus* Wiedemann were found to be truly coprophilous, actually breeding in this medium; *A. consimilis* and *A. badius* Boheman were found even after the droppings had dried out to some extent. *Aphodius badius*, which is rather similar to another small, dull, dark-brown scarab *Drepanocanthus lineatus* (Wiedemann), but much smaller, has in addition been collected in fresh dung on the beach along the west coast of the Cape Province together with the previously mentioned *Epirinus aeneus*.

Most of the *Aphodius* species are widely distributed: *A. procerus* (Fig. 16A) and *A. maculicollis* Reiche occurred more commonly to the east of the Cape Peninsula and in the Karoo, while *A. hepaticus* Roth was found only in June in fresh dung in the Little Karoo. All the other species occurred almost throughout the year, *A. consimilis* being particularly abundant during the early spring. This species is often attracted to lights in houses, especially during the late summer and autumn.

The larvae of *A. laetus* and *A. procerus* were fairly heavily preyed upon during the winter and early spring by the larvae of a black and white-banded dexiid, *Pretoriamyia sellifera* van Emden, which occurred throughout the survey area. The larvae of an unidentified muscid of the genus *Helina* were also responsible for the destruction of various small scarab grubs, mostly *Aphodius* species, and it seemed to have the same habits and distribution as the species of *Pretoriamyia*.

Puparia of *Helina* spp. can easily be separated from those of *Pretoriamyia* by the small pale posterior spiracles placed close together at the hind end. In *Pretoriamyia* the spiracles are larger and black and situated on the dorsal side of the hind end.

Another aphodiine found in large numbers in fresh dung is the abovementioned *Drepanocanthus lineatus*. It was collected in almost all areas during winter and spring; in the northern parts it appeared together with *Coptochirus excisus* Harold, which is much smaller and more shiny. Along the south coast it was found in association with *Harmogaster intrusa* (Peringuey) a small, dull,

dark-brown species with black pronotum. *Coptochirus pallidipennis* Harold, and *C. brachypterus* Harold, were found to be very numerous in the Mamre area during September when large numbers of both were seen to copulate. *Coptochirus emarginatus* (Germar), a very common species in fresh and partly fresh dung all along the west coast almost throughout the winter and early spring, often occurs in large numbers in factories manufacturing materials that contain feathers, such as quilts.

All the *Coptochirus* species mentioned here are small (4,6–5 mm long), and are recognized by the emarginate anterior border of the head. *Coptochirus emarginatus, C. pallidipennis* and *C. excisus* are light brown, with the pronotum and head a darker brown in the middle. The first-named species also has dark-brown patches on the elytra. *Coptochirus brachypterus* on the other hand has the pronotum and head almost black in the middle and the elytra in the specimens examined are darker than in the other three species.

A large number of small scarabs were still present in partly dry cow-pats that were examined and of these the following were found to be prevalent: *Aphodius moestus* Fabricius, *A. bidentulus* (Harold), *A. lugubris* (Boheman), *Oniticellus pictus, Coptochirus pallidipennis, C. brachypterus, Onthophagus cameloides, Harmogaster exarata* Harold, the two scarabaeines, *Odontoloma dentinum* (Harold) and *O. pygidiale* Peringuey, *Aphodius discoidalis* Boheman and sometimes also *A. badius, A. rubricosus* Boheman, and the black maize-beetle, *Heteronychus arator* Burmeister (subfamily Dynastinae). The last two species even occurred when the pats were very dry and their crust hard and firm, while *A. moestus* also bred in fresh and semi-fresh pats.

All the *Aphodius* species are more or less dark brown, but *A. moestus* (Fig. 15E) has lighter elytra, marked with short, longitudinal, black stripes. It is widely distributed in South Africa and its larvae are most often found in association with those of *A. consimilis. Aphodius lugubris* on the other hand seems to be more restricted to the west coast and appears in rather small numbers throughout the spring and autumn; it is commonly found to breed in the decaying reeds in thatched roofs of houses and rondavels. The shiny-brown *Aphodius discoidalis*, almost of the same size as *A. moestus* (about 7 mm), was collected in fairly large numbers near Melkbos during March, whereas *A. bidentulus* (4,5–5 mm long), which is slightly shiny and black, was found in the Heidelberg area of the Cape Province during the early winter in semi-fresh to almost dry cow-pats.

Oniticellus pictus, already mentioned in connection with fresh dung, was collected in almost dry pats near Hermanus and further east along the south coast. *Oniticellus militaris* Castelnau (about 9 mm long, dull dark brown, with rather indistinct black markings on the elytra), was found to be common in the autumn in semi-fresh and also fairly fresh cow-dung near Mossel Bay and in the Robinson Pass. *Coptochirus pallidipennis* and the almost black *Harmogaster exarata* were occasionally found in very large numbers in fairly fresh as well as in partly dry dung in most of the areas investigated. The latter is easily distinguished from *C. pallidipennis* by the structure of the striae on its elytra. Of the species

invading fresh dung, *Aphodius consimilis* and *A. procerus* together with *Onitis caffer* remained in the dried-out dung for fairly long periods.

Odontoloma dentinum (3,4 mm long), dull black in colour with striae similar to those of the previously mentioned *Onthophagus cameloides*, and *Odontoloma pygidiale*, similar to *O. dentinum*, but lacking the longitudinal, smooth line on the anterior part of the pronotum, were collected together with other small scarabs in semi-fresh dung near Stilbaai during the autumn and near Elands Bay during midwinter. Both species seem to be restricted to the southern part of southern Africa according to collections that were made in the past.

Usually the larvae of only one species were found in a single cow-pat; in the case of *Aphodius laetus, A. moestus* and *A. consimilis*, however, the larvae were collected in the same pats.

The other two smaller subfamilies belonging to this group of scarabs, the Geotrupinae (with three tribes of which only one, the Bolbocerini with about forty species, is represented in southern Africa) and the Troginae (with one Subsaharan genus comprising forty-two southern African species), are often placed as separate families.

Only three trogids were collected during the surveys, the largest being the previously mentioned *Trox horridus* Fabricius (Fig. 14C), 17–18 mm long with penicillate tubercles as well as serrate lateral margins. It was often observed during the winter months on or in the vicinity of dry cow-pats near Saldanha. It differs from *T. fascicularis* Wiedemann (Fig. 13B), which was occasionally attracted to partly-fresh dung, by its size and by the absence of wings. This latter species is also dull black and widely distributed in the Cape Province and Natal. Another small species, *T. rhyparoides* Harold, occurred only in decaying carcasses. The larvae of one of the largest members of this subfamily, *T. procerus* Harold, not present in southern Africa, but widely distributed in the arid parts of north Africa and Arabia, have been observed by Van Emden (1948) to feed on the eggs of the desert locust, *Schistocera gregaria* (Forskål) in Somalia.

The second group of scarabs includes the major phytophagous members, better known as chafer-beetles, cockchafers, June beetles, Christmas beetles, monkey-beetles, fruit-beetles and rhinoceros-beetles. Some of them often swarm in large numbers during the spring, defoliating fruit and forest trees; a few species, however, are predacious. The larvae are typically scarabaeiform as in the first group, C-shaped (except in certain members such as the fruit-beetles), whitish, with well-developed legs increasing in length from front to back, and with pale reddish-brown head, either with or without ocelli. They are known as white grubs and feed on dung, other decaying organic material, or on the roots of plants, and may cause severe damage to cultivated crops and lawn grass.

The rhinoceros-beetles (subfamily Dynastinae) contain about sixty southern African species, mostly dark brown to black in colour, with ten-segmented antennae. The most common and widespread member is probably the shiny

dark-brown *Oryctes boas* (Fabricius), 35–40 mm long, with a long curved horn on the head of the males. One of the largest Subsaharan species is *Dynastes centaurus* (Fabricius), measuring about 55 mm long and occurring also in the north-eastern parts of South Africa. (Males of the large Hercules beetle *D. hercules* (Linnaeus) of Central America and the West Indies measure up to 130 mm, including the horn.)

In the larvae of this subfamily, which generally feed on roots or other decaying vegetable matter, the labrum is usually asymmetrical and the ninth and tenth abdominal terga are completely fused (Crowson 1967). This is apparently not the case with all the members of this subfamily (see description of the larva of *Temnorrhynchus retusus* (Fabricius), p. 290). In the case of the previously mentioned black maize-beetle, *Heteronychus arator*, commonly found under semi-dry to dry cow-pats, the larvae do very little damage; the adults, however, may cause severe damage to young maize plants, trees, etc., and even lawn grass. The larger *H. licas* (Klug), widely spread in the Subsaharan region, including the north-eastern parts of South Africa, often causes considerable damage to maize and sugar-cane in Mozambique (Jerath 1966), and in this case both larvae and adults are responsible. *Heteronychus consimilis* Kolbe, which is of about the same size as the black maize-beetle, is a serious pest of wheat in Kenya (Le Pelley & Goddard 1952); according to collection records it does not occur in South Africa. The larvae of a few species are found in termite mounds and feed on the material of which the mounds are made.

A regular visitor on the open beach along the west coast is the piceous-red *Temnorrhynchus retusus* (Fig. 14E), rarely seen because of its habit of burrowing into the sand, most often just above the low-water line. Larvae of this species feed on plant roots and other organic matter and are common in sandy soils throughout the year in certain parts of the Cape Peninsula. It is also present on Dassen Island. The larvae of a related species, *T. coronatus* (Fabricius), somewhat bigger than *T. retusus* (about 23 mm long) and widely spread in the Subsaharan region including South Africa, sometimes damage the underground parts of strawberry plants (Oberholzer 1963).

Some 270 species of fruit-beetles (subfamily Cetoniinae) have been recorded in southern Africa, the largest members found in the Republic of South Africa being the black and light-grey *Goliathus albosignatus* Boheman (45–55 mm long) and the green and white *Dicranorrhina derbyana* Westwood (35–50 mm long). This subfamily includes the large, robust, maroon-coloured Goliath beetle *Goliathus goliathus* (Drury), of tropical Africa, which may reach a length of 90 mm or more.

The larvae of these beetles usually feed on humus, particularly in compost heaps, dead logs, etc., and are not curled like the other scarabs, but are able to stretch their bodies and walk horizontally or even slide in a worm-like motion on their backs. The ninth and tenth abdominal terga are completely fused as in the dynastids, but the labrum is always symmetrical (Hayes 1929).

The adults, with ten-segmented antennae, are diurnal and usually feed on nectar. Members of the genera *Pachnoda* and *Rhabdotis* are particularly fond of ripening fruit and may cause considerable damage in orchards. The genus *Rhinocoeta* includes three species that generally fly at night and are coprophagous. *Rhinocoeta cornuta* (Fabricius) is the most wide-spread, its larvae being common in partly fresh cow-pats along the south coast. Another typical member is *Trichostetha fascicularis* (Linnaeus), about 23 mm long with green elytra and black prothorax having four thin white longitudinal lines. It is common in proteas, particularly the king protea (*Protea cynaroides*), often in association with the smaller brownish *T. capensis* (Linnaeus), the larvae of which are also known to cause destruction to thatched roofs in the Cape Peninsula, and *T. signata* (Fabricius) whose larvae are occasionally found in dassie dung in the same area. The larvae, when full grown, construct a fairly hard earthen cocoon in which the pupae are formed. Immature stages of *T. capensis* have been observed in the mounds of termites (*Termes* spp.), sometimes together with those of the large dark-brown dynastid, *Pseudocyphonistes corniculatus* (Burmeister) (adults 30–40 mm long). They both feed on the material of which the mounds are made. The larval stage of some species, such as the brownish-yellow and black to piceous *Stripsipher zebra* Gory & Percheron, is usually spent in rotten logs; however, they are often found causing considerable damage to thatched roofs, as in the case of the above-mentioned *Trichostetha capensis*. Some members of the tribe Trichiini, such as *Agenius limbatus* (Olivier), are often found under completely dry cow-pats.

The tribe Cremastochilini contains several members which are either found in birds' nests, in ants' and termite nests, or occur in beehives. At least two species, *Pseudospilophorus plagosus* (Boheman), shiny black with two large whitish marks on the elytra as well as an oblong whitish mark near the elytral apices, and about 12 mm long, and *Brachymacroma emarginicollis* (Boheman), of about the same length and black with large yellowish patches, are predacious, feeding on the yellow aphid, *Aphis nerii* Boyer de Fonscolombe, on milkweed plants (*Asclepias* spp.) (Skaife 1953). *Pseudospilophorus lugubris* (Fabricius), similar to *P. plagosus*, but lacking the distinct oblong mark on the elytral apices, often occurs in the nest of the social spider (*Stegodyphus* sp.) of the family Eresidae.

According to Peringuey (1907) the species of *Pseudospilophorus* breed in the nests of small birds such as finches, etc., feeding in both the larval and adult stage on the faeces of the young birds. This also applies to the large, shiny, black hive-beetle, *Diplognatha gagates* (Forster) (18–30 mm long—tribe Diplognathini), the larvae of which construct a fairly hard earthen cocoon in which pupation occurs, as is the case with the above-mentioned species.

Members of the genera *Hoplostomus*, such as the shiny black *H. fuliginosus* (Olivier), a typical cetoniid (about 23 mm long), and *Goniochilus*, particularly the black and dark-red *G. bicolor* Harold (about 22 mm long), are often attracted to beehives where they feed on the honey. The shiny-black *Genuchus hottentottus* (Fabricius), about 10 mm long, on the other hand, is commonly found in the

flowers of the sugar-bush (*Protea repens*), feeding on the nectar, and occasionally appears in the carton nests of the cock-tail ant, *Crematogaster peringueyi* Emery, in the Cape Peninsula. The reason for their presence in the ants' nest is still unknown, but from observations it seems certain that they are treated as persecuted synoeketes.

Species belonging to at least six genera of the tribe Cremastochilini have been observed to be myrmecophilous or termitophilous, most of them apparently being treated by the hosts as persecuted synoeketes as in the case of the species belonging to the genus *Genuchus*. *Coenochilus*, the biggest genus of this particular section, includes about sixteen southern African species, most of which are fairly widely distributed. Peringuey (1907) particularly mentions the large, dark-brown *C. hospes* Peringuey (about 24 mm long) from the mounds of the large fungus-grower termite, *Odontotermes transvaalensis* (Sjöstedt). Another member, the dark-brown *Trichoplus aegyptus* Kolbe, often occurs in the mounds of the harvester termite *Microhodotermes viator* (Latreille) in Namaqualand.

Adults of about seven species were found to occur in the nests of the pugnacious ant, *Anoplolepis custodiens* (Smith), viz. *Trichoplus vicinus* Peringuey, *T. schaumi* Westwood, *Plagiochilus diversus* Peringuey, *P. intrusus* Peringuey, *Scaptobius capensis* (Gory & Percheron), *Placodidus compransor* Peringuey, and *Myrmecochilus marshalli* Wasmann. They are all flattened, dark-brownish beetles, about 9 mm long, except the last which is about 15 mm long and black with a whitish band along the sides of the body. Species of the genus *Trichoplus* mentioned above are easily recognized by their very concave prothorax. *Coenochilus appendiculatus* Gerstaecker was apparently found in the nest of the black sugar-ant, *Acantholepis capensis* Mayr, according to Schein (1954), as well as in the mounds of a large fungus-grower termite (*Macrotermes* sp.).

The subfamilies Rutelinae and Melolonthinae include the chafer-beetles or cockchafers and monkey-beetles. Both subfamilies are well represented in southern Africa and contain species of economic importance.

In the Rutelinae, with about a hundred southern African species, the adults have nine- to ten-segmented antennae and in the larvae the ninth and tenth terga are distinct. In this case the anus is not angulate in the middle. At least about seven species are harmful, including the maize-chafer beetle *Chaetadoretus cribrosus* (Harold), the pecan-beetles *Anomala probativa* Peringuey and *Adoretus laticeps* Fåhraeus, the two wattle-chafers *Anomala caffra* Burmeister and *Adoretus ictericus* Burmeister (Fig. 141), and sometimes also *Adoretus tessulatus* Burmeister, which feeds at night on rose leaves (Smit 1964). *Adoretus ictericus* is often attracted to sites of decaying carcasses, mostly during the late ceratophagous stage when the soil is enriched with organic matter; in this case their larvae have on various occasions been recovered from the soil under the carcasses.

Nearly 900 species of melolonthids occur in southern Africa, some of the largest South African members being the dark-brown species, *Macrophylla*

pubens Peringuey (about 27 mm long) and *M. maritima* Burmeister (about 33 mm long), both from the southern and eastern Cape Province. The adults of these beetles have nine- to ten-segmented antennae and in the larvae the ninth and tenth terga are also distinct; the anus, however, is angulate in the middle in this case.

The larvae of at least five species of *Macrophylla* cause severe damage to golf- and bowling-greens in the eastern Cape Province. In Zimbabwe the large brownish *Eulepida mashona* Arrow (about 25 mm long), with short decumbent hairs giving it a greyish appearance, is regarded as a pest of maize, whereas the smaller (about 15 mm long) shiny, dark-brown *Schizonycha profuga* Peringuey, of the same distribution, damages tobacco plants. According to the collection data they do not occur in South Africa. *Eucamenta castanea* (Boheman) (Fig. 14H), very similar to *S. profuga* and of about the same size and colour, is sometimes attracted to decaying carcasses in the Cape Peninsula together with *Adoretus ictericus* during the last post-mortem stage; its larvae, however, have never been recovered under such circumstances.

The most abundant melolonthids are the monkey-beetles (tribe Hopliini), which are mostly attracted to flowers, particularly burrowing in yellow and white flowers of the family Compositae. One of the most common in the western Cape is the hairy black *Anisonyx ursus* (Fabricius), which is about 10 mm long. These beetles are usually very abundant for a short while during the spring, but then disappear until the following spring. They are easily recognized by the enlarged and long hind legs, especially of the males. Adults of most of the species are often attracted to decaying matter. However, very little is known about their life-cycle; it is probably the same as that of the small wattle-chafer, *Monochelus calcaratus* Burmeister (see Prins 1965). Some of the largest members of this tribe are the dark-brown *Hoplocnemis hylax* (Fabricius) and *H. spectabilis* Peringuey of the eastern Cape Province, and *H. koikoina* Peringuey of Namaqualand (males of all these species about 15 mm long).

Aphodius laetus Wiedemann

DESCRIPTION

Adult

Previously described by Peringuey (1901). Very similar to *Aphodius procerus* (Fig. 16A) but smaller, being 6.6–8.3 mm long. Head and pronotum dark brown to almost black; elytra lighter, yellowish brown to flavous; moderately shiny.

Widely distributed in the Cape Province; also found in Natal and Senegal (Schmidt 1910).

Larva

Mature larva 9–10 mm long. Whitish to bluish white with semi-matt, brown head; frons pale brown to almost yellowish and *A. laetus* is therefore easily recognizable. Overall shape like that of *A. procerus*, but smaller. The thoracic

spiracles oblong and somewhat larger than others; area in front of spiracle very convex. Abdominal segments 1–6 with three annulets, segments 7–8 with two annulets. Each annulet with a row of fine hairs; those on segments 2–5 short and spine-like in older specimens. Legs sparsely covered with hairs, basal half of coxae almost devoid of hairs. Claws simple and more distinctly demarcated than in *A. procerus* (Fig. 15N).

Head (Fig. 15I)

Epicranial suture distinct. Frons lighter coloured than rest of head, with four anterior frontal and four posterior frontal setae, both forming two curved rows. Mesal side of frons near base also with setae, as in *A. procerus*. Epicranium darker than frons, as already stated, and with four to six lighter spots, each with a long seta. Lateral sides of epicranium with numerous short setae. Antennae with four large movable segments and a small fifth segment bearing sensilla. Setal pattern very similar to that of *A. procerus*, except for very small setae on epicranial sides.

Labrum and clypeus

Labrum slightly shorter than clypeus, the two clithra clearly visible dorsally. Median row of four long setae present; posterior to this row are two shorter setae, just in front of clypeal border. Median lobe dorsally with two long setae as well as four strong setae on extreme anterior border as in *A. procerus*. One long and two short setae also present laterad of each clithrum on lateral lobes. Clypeus about 1,25 times the length of the cranium, with one long and one short seta on each side of postclypeus, as well as two shorter paramedian setae.

Epipharynx (Fig. 15K) very similar to that of *A. procerus*, but each acanthoparia consisting of only four setae, of which one is situated in front of each torma as in latter species. Tormae fairly symmetrical and central area of pedium also similar to that of *A. procerus*, but distal section of hairs flanking anterior part of epitorma, more strongly developed than rest of hairs and much more pronounced.

Mandibles (Fig. 15P)

Rather similar to those of *A. procerus* (Fig 16K), but neck of mandible in region of scissorial teeth (t_2 and t_3) and molar area wider and only two setae visible on exterior margin in specimens examined. Scrobis on each mandible indistinct and dorsal carina rounded and weak. First molar tooth (m_1) narrower than in *A. procerus* and straighter; transverse groove on right molar area almost obsolete; ventral section of molar area of right mandible forms separate piece between m_3 and m_4, which is not so pronounced in *A. procerus*. Stridulatory area absent on both mandibles. Dorsomolar setae (xy) on both mandibles similar to those of latter species.

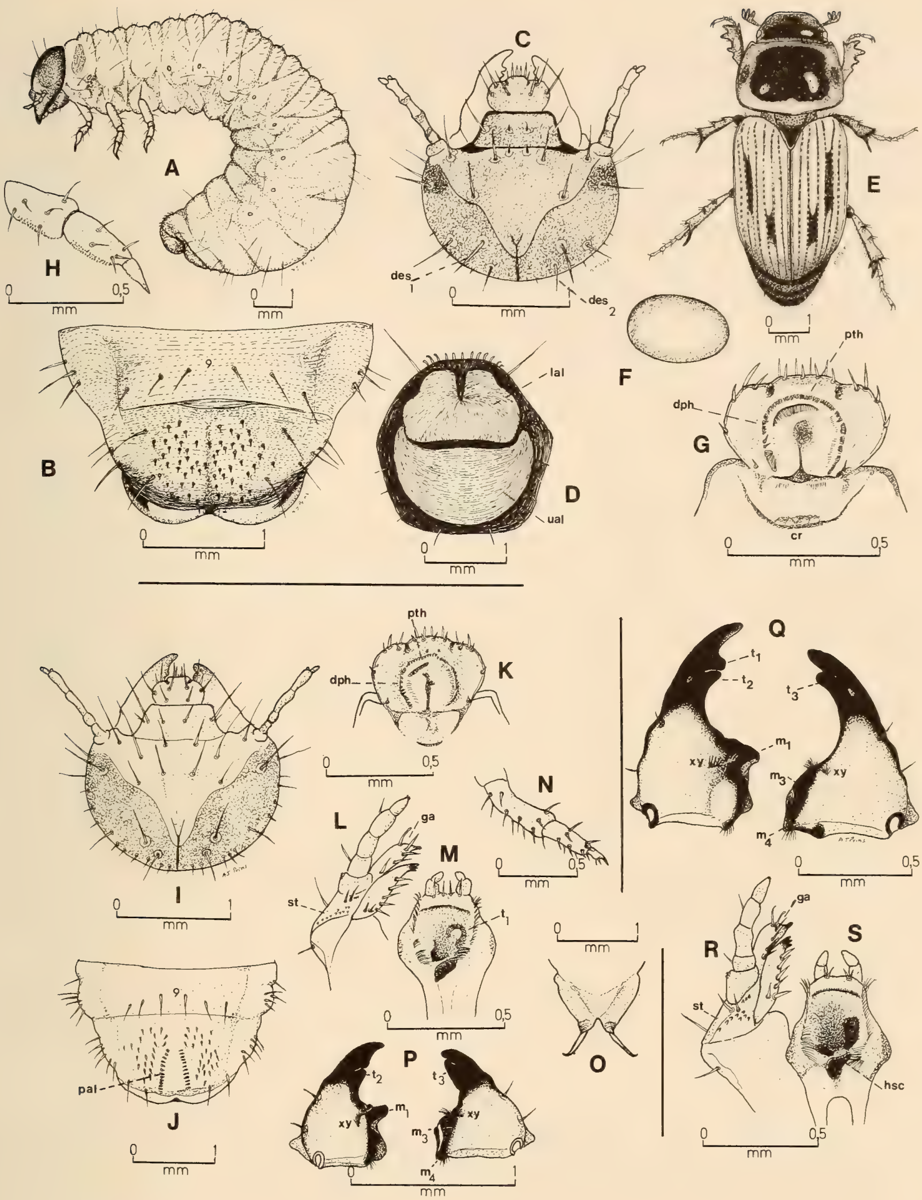

Fig. 15. Scarabaeidae. A–H. *Aphodius moestus*. A–D. Larva. A. Left lateral view. B. Apical abdominal segment, ventral view. C. Head, dorsal view. D. Anal opening, viewed directly from the rear. E. Adult. F. Egg. G–H. Larva. G. Epipharynx. H. Right mesothoracic leg. I–P. *Aphodius laetus*. I–N. Larva. I. Head, dorsal view. J. Apical abdominal segment, ventral view. K. Epipharynx. L. Left maxilla, dorsal view. M. Hypopharynx. N. Right mesothoracic leg. O. Pupal hooks, ventral view. P. Mandibles, dorsal view (larva). Q–S. *Aphodius moestus* larva. Q. Mandibles, dorsal view. R. Left maxilla, dorsal view. S. Hypopharynx.

Maxillae (Fig. 15L)

Very similar to those of *A. procerus*; the galea free for most of its length. Latter with a single tooth and five setae on dorsal side; ventrally with longitudinal row of eleven to twelve strong setae, situated close together (as in *A. procerus*), as well as single seta close to uncus. Lacinia ventrally with two setae of which apical one is strong and tooth-like and situated near the three unci. Mala dorsally with seven strong setae. Stipes with two dorsal setae and row of eight to eleven small stridulatory teeth. Also two to three teeth near border of palpifer, which has no teeth, but some papillae on its exterior border. Labacoria dorsally bare, but with three setae on ventral side. Stipes also ventrally with one distal and one proximal seta; latter located near border of galea. Palpifer and first segment of maxillary palp each with long ventral seta; penultimate segment also with one ventral and one external seta. Alacardo with one seta.

Labium

Very similar to that of *A. procerus*, distal sclerite of prementum as well as proximal sclerite each with two long setae; postmentum with one or two setae on each side; also two setae close together near anterior margin of distal sclerite of prementum.

Hypopharynx (Fig. 15M) very similar to that of *A. procerus*; posterior tooth of oncyli also strongly developed, but tooth t_1 very weak in specimens examined.

Ninth and tenth abdominal sterna (Fig. 15J)

Similar to *A. procerus*. Ninth sternite bearing transverse row of six setae; division between the two segments clearly indicated. *Raster*: tegilla separate as in *A. procerus*, each consisting of about twenty-five spine-like setae. Septum present and wider posteriorly, flanked on each side by about ten to twelve pali. Otherwise as in latter species. Anal lips similar to those of *A. moestus*, but both of the same size in most specimens seen.

Pupa (Fig. 15O)

Yellowish white and very similar to that of *A. procerus*, but smaller. Length 6,2–7,0 mm (posterior hooks excluded).

BIOLOGY

Aphodius laetus beetles were collected in fresh and semi-fresh cow-dung almost throughout the year. Larvae were observed during the winter and spring and were found together with those of *A. consimilis*. They were fairly heavily parasitized by the dexiid, *Pretoriamyia sellifera* van Emden. When mature, the larvae construct soft clay cells either in the soil or in the dung in which the prepupae and pupae are formed.

The pupal stages lasted about 21 days in the laboratory during the winter and 12–14 days during the summer; adult beetles emerged during midwinter and early summer.

Aphodius moestus Fabricius

DESCRIPTION

Adult (Fig. 15E)

Previously described by Peringuey (1901). Straw-coloured and fairly shiny, particularly on pronotum; head and pronotum dark brown to almost black. Each elytron with two narrow, longitudinal, blackish marks. On each side of pronotum also brownish to blackish patch. Striae on elytra well indicated but not deeply punctate. Length 5,8–7,5 mm.

Widely distributed in Subsaharan region, also present in Sri Lanka, Madagascar and Malaysia (Schmidt 1910).

Larva (Fig. 15A)

Bluish white, with head dull, dark brown. Length 10,5–12,5 mm. Rather similar to *Aphodius laetus* and *A. procerus*. Abdominal segments 1–5 each divided into three annulets; segments 6–8 apparently with two annulets each. Sparsely covered with setae all over the body, with most setae on abdominal segments 1–5 small and spine-like. Each abdominal sternum with transverse row of four to six setae on middle. All legs more or less of same size, well developed and sparsely covered with setae, particularly coxae; claws (Fig. 15H) simple and acute, lacking two spine-like setae present in *A. laetus*; ventral surfaces of claws serrate and studded with minute denticles. Both femur and tibia with minute denticles on ventral side (absent in *A. laetus*).

Head (Fig. 15C)

Frontal sutures rather indistinct in old specimens, epicranial stem (coronal suture) as in *A. laetus*. Frons somewhat lighter in colour than epicranium in some specimens, in others just as dark and bearing only three long setae on each side. Two short paramedian setae or spines also present below frontoclypeal suture, forming part of anterior frontal setae. Epicranium with anterior corners darker in most specimens seen, dorsally with four setae as in *A. laetus*, as well as some minute setae on lateral margins, which are, however, not as conspicuous as in latter species. Antennae slightly shorter than cranium, with four large and small fifth segments; separation of the first two segments very indistinct.

Labrum and clypeus

Setal pattern of labrum as in *A. laetus*, except two posterior setae immediately in front of clypeal border absent. Clypeus about as long as labrum; very convex in lateral view and with one long seta on each side, as well as two smaller paramedian setae.

Epipharynx (Fig. 15G) as in *A. laetus*, except crepis is much better indicated and distal section of hairs flanking anterior part of epitorma larger, covering almost whole of protophoba. Two or three strong setae in central part of dexiophoba are characteristic of both this species and *A. laetus*; they are not as obvious in *A. procerus*.

Mandibles (Fig. 15Q)

Stridulatory areas absent in both mandibles. Lateral side of each mandible rounded dorsoventrally, without distinct dorsal carina and with imperfect scrobis. Only two small setae observed on each mandible of which proximal one is situated on lateral face. Cutting edges very similar to those of *A. laetus*; apical tooth much longer on both mandibles. On left mandible scissorial notch much more distinct and second tooth (t_1) fairly obvious in most specimens, giving cutting edge a tridentate appearance. In both mandibles the neck much longer than in *A. laetus*. Molar areas of both mandibles similar to those of the latter; dorsomolar setae, however, arranged in form of transverse row on left mandible.

Maxillae (Fig. 15R)

Similar to that of *A. laetus*. Galea and lacinia free apically, latter with seven strong setae on dorsal side and apically with three unci. Ventrally with two setae only, apical one spine-like as in *A. laetus*. Galea bears single uncus, with two adjacent curved setae as well as longitudinal row of closely adjoining setae ventrally; dorsally with about seven strong setae of which two are situated on lateral side of uncus. Stipes with two setae dorsally and a row of eight to nine stridulatory teeth; also about three stridulatory teeth near base of palpifer; ventrally with only single proximal and single distal seta, as in *A. laetus*. Palpifer and basal palpal segment with single ventral seta; penultimate segment with one ventral and one lateral seta. Labacoria with three ventral setae.

Labium

Similar to that of *A. laetus*, but with only two long setae on postmentum.

Hypopharynx (Fig. 15S) also very similar to that of *A. laetus*, except that hypopharyngeal sclerite is somewhat better sclerotized. Glossa with same number of setae as in latter species.

Ninth and tenth abdominal sterna (Fig. 15B)

Distinct line of demarcation between ninth and tenth sternum present as in *A. procerus*. *Raster* very different from that of either *A. procerus* or *A. laetus*, as septum is absent. Two tegilla more or less fused, and with about seventy small black tubercles, each with small hamate seta (almost as in *Oniticellus*). Barbula absent. Anal opening visible as transverse slit (Fig. 15D), lower anal lip smaller than upper lip and divided ventrally by acute emargination; lateral margin on each side slightly emarginate in most specimens seen; very similar to *A. laetus* and *A. procerus*, but ventral incision much deeper.

Pupa

Similar to that of *A. procerus* (Fig. 16L), including caudal hooks. Length 6,5–7,4 mm (excluding caudal hooks). Colour pale whitish brown, but turning to dark colour a few days before beetle emerges.

BIOLOGY

Eggs of *Aphodius moestus* (Fig. 15F) were found in fresh cow-dung near Montagu during the summer months. They are whitish, oval and matt, 1,5 mm long and 1,0 mm broad. All the eggs collected during the summer had an incubation period of at least 5–6 days, the young grubs being about 2,5 mm long just after hatching. At first they are almost pure white, but soon the head becomes darker, almost golden brown. The setal pattern of the first instar is almost the same as that of the mature larva, except that the very small paramedian setae on the clypeus and the median pair of anterior frontal setae are absent. In all specimens seen, the posterior pair of dorso-epicranial setae (des_2) is also absent.

Large numbers of full-grown larvae and pupae were found in fresh dung during the autumn and beetles were observed almost throughout the year. The life-cycle from egg to adult during December and January occupied 30–33 days. All the pupae collected were found in small clay cells in the partly dry dung which remained after the feeding of the various coprophagous insects.

The newly-emerged beetle is pale brownish yellow, almost straw coloured on the elytra as well as on the pronotum, with the central part of the latter brownish; the head is brown and the legs yellowish. After a day or two it assumes its normal colour.

Aphodius procerus Harold

DESCRIPTION

Adult (Fig. 16A)

Previously described by Peringuey (1901). Brownish in colour, with prothorax darker in middle and usually finely pitted. Elytra striate, the striae with one row of punctures each. Head also finely punctate. Prothorax about as wide as elytra and whole insect moderately shiny. Length 11–12,5 mm.

Widely distributed in the western Cape (Peringuey 1901).

Larva (Fig. 16H)

Mature larva measures 16–17 mm in length. Colour bluish white, with head dark blackish brown to almost black, and matt. Abdominal segments 1–6 with three annulets; setae on segments 2–6 short and almost spine-like. Legs sparsely covered with setae. Claws (Fig. 16G) simple and acute, each bearing two small setae near base. Each abdominal sternite, except segment 10, with transverse row of six to eight long setae.

Head (Fig. 16I)

Frontal sutures distinct. Areas around antennal bases whitish, anteclypeus and labrum yellowish to brownish yellow. Frontoclypeal suture distinct. Frons with only two long setae on each side and also two short paramedian anterior frontals. Epicranium with four setae on dorsal side as in *Aphodius laetus* and

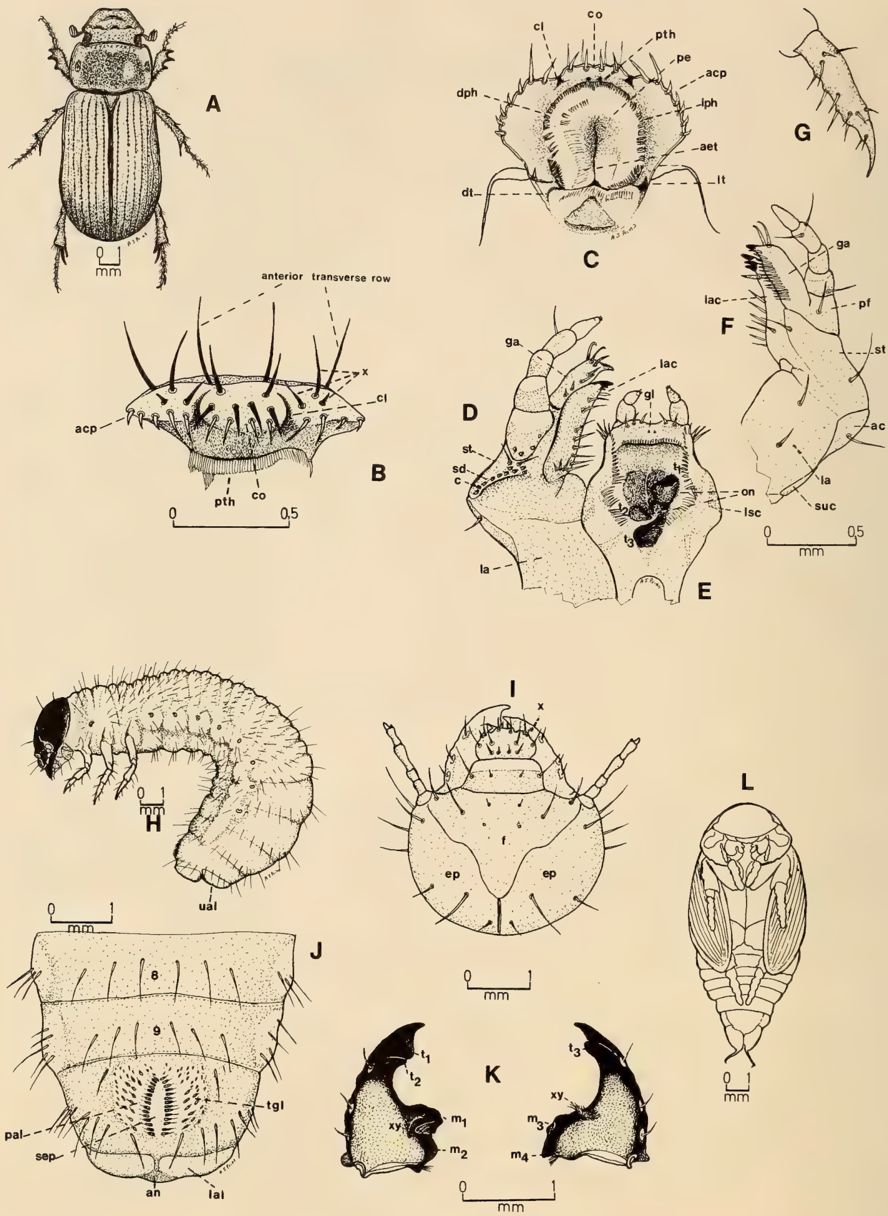

Fig. 16. Scarabaeidae. *Aphodius procerus*. A. Adult. B–K. Larva. B. Anterior margin of labrum, viewed directly from the front. C. Epipharynx. D. Left maxilla, dorsal view. E. Hypopharynx. F. Left maxilla, ventral view. G. Right mesothoracic leg. H. Larva, left lateral view. I. Head, dorsal view. J. Apical abdominal segments, ventral view. K. Mandibles, dorsal view. L. Pupa, ventral view.

A. moestus. Antennae slightly more than half the length of cranium, with five movable segments of which apical one is very small and bears two oval sensory grooves.

Labrum and clypeus

Labrum divided by clithra; median lobe bearing four strong setae dorsally on extreme anterior margin and two long setae further posteriorly (Fig. 16B). One long and two short setae (x) present laterad of each clithrum on lateral lobes (Fig. 16B, I); posterior to these are two transverse rows of four setae each; in some specimens posterior row contains only two to three setae. Clypeus of about same length as labrum and bearing transverse row of four setae on postclypeus.

Epipharynx (Fig. 16B–C). Distinct clithrum present on each side of corypha; latter with four medium long spine-like setae. Pedium large, raised and encircled by setae of proto-, dexio- and laeophobae. Tormae (dt and lt) narrow and merely indicated by suture; anterior epitorma elongate and ending in central cavity. Each torma with short spine on lateral margin, which apparently forms part of acanthoparia. Central area of pedium concave; anterior epitorma flanked on right by fine hairs. Each acanthoparia with five short stout spines and distally with two longer spine-like setae. Chaetoparia and acroparia absent. Boundary line of epipharynx and pharynx not clearly indicated by crepis in specimens examined; area enclosed by latter (also known as haptolachus, which is actually situated on clypeus) only with triangular sclerotized plate, in front of which is transverse row of fine hairs.

Mandibles (Fig. 16K)

Nearly as long as the cranium; dorsal carinae rounded and not clearly indicated; scrobis imperfect and bearing three short, sickle-shaped setae. Cutting edge of left mandible blade-like; scissorial notch distinct on both mandibles. Posterior scissorial tooth (t_3) on the right mandible rounded in most of specimens examined. Molar area of left mandible divided into distal and proximal lobe; distal lobe (m_1) with broad transverse cutting edge, with curved row of dorsomolar setae (xy); proximal lobe (m_2) broad, its dorsal aspect sharp. Molar area of right mandible entire, with transverse groove in front of small ventral tooth (m_3) and bearing fine setae (xy); proximal tooth (m_4) pointed posteriorly. Fine setae on posterior part of molar area of both mandibles present as brustia.

Maxillae (Fig. 16D, F)

Galea and lacinia fused, but delimited dorsally and ventrally by deep suture; apices free. Galea bearing single strong apical uncus and two to three strong curved setae; dorsally with longitudinal row of about five strong setae and ventrally with another row of closely approximated slender setae. Lacinia with three well-developed apical unci. Mala dorsally with row of nine to eleven strong setae, and ventrally with only one strong seta near unci; also with another seta close to its base. Stipes dorsally with two setae close to base of palpifer as well as well-defined carina (c) with row of about nine stridulatory teeth. Base of palpifer

also with four stridulatory teeth; ventrally with single seta. Labacoria bare on dorsal side but ventrally with two long setae. Alacardo on both sides with single seta. Maxillary palp with four movable segments; ventral side of basal segment with single seta and also one on both external and ventral sides of penultimate segment.

Labium

Mentum trapezoidal, with strong seta on each side near base. Proximal sclerite of prementum wider than distal sclerite, fairly convex transversely in lateral view and with two paramedian setae. Distal sclerite with two setae close together near anterior margin; sclerite consisting almost of two parts due to presence of shallow longitudinal depression; each part with long median seta.

Hypopharynx (Fig. 16E). Distal region of glossa with three setae on each side. Transverse ridge in front of oncyli bears row of fine setae. Hypopharyngeal sclerite concave in middle; oncyli consisting of at least three strongly sclerotized teeth (t_1, t_2, t_3). Lateral sclerites not strongly developed. Oblique row of fine setae present on each side, laterad of oncyli, each row continuing anteriorly over lateral area of glossa, terminating on ventrolateral side of distal sclerite of prementum in three strong setae.

Ninth and tenth abdominal sterna (Fig. 16J)

Dividing line between these segments distinct. Lower anal lip (lamina sub-analis) divided into two sections in middle; upper anal lip (lamina supra analis) entire; both lips demarcated by thin, well-defined suture. Anus present as transverse slit. Barbula absent. *Raster*: tegilla separate; each tegillum with eleven to thirteen strong setae similar to pali, as well as some smaller spine-like setae. Septum long, wider in the middle; each pallidium with fourteen strong pali. Campus small, bearing only one long seta on either side of tegilla. Oblique row of long setae also present in front of anal lips.

Pupa (Fig. 16L)

Light or pale brownish, 11–12 mm long. Bare, almost without setae. Abdomen dorsomedially with carina as in *A. laetus*. Wing-covers longitudinally striate. Extreme apex of abdomen carrying two long hooks, which are curved inwards at tips. Few days before beetle emerges, pupa turns dark brown to piceous.

BIOLOGY

Aphodius procerus beetles were mainly observed during the winter and spring. The larvae feed on semi-fresh to semi-dry cow-dung and were collected from late autumn to early spring; they are easily recognized by the dull, dark-brown to almost black heads, which are white after each moult. Before the prepupal stage is reached the larva constructs an earthen cell either in the dung or in the upper few centimetres of soil, in which the prepupal and later, after a few

days, the pupal stage is formed. Pupae were found during the winter and early spring. Pupal stages lasted from 17–23 days and beetles emerged from August to October.

Aphodius consimilis Boheman

DESCRIPTION

Adult

Previously described by Peringuey (1901). Rather similar to, but somewhat shinier than *Aphodius moestus* and without longitudinal black stripes on elytra; punctato-striations less distinct. Smaller than latter, only 4,2–5 mm long.

Widely distributed in the Cape Province, also present in Mozambique (Schmidt 1910).

Larva

Very similar to *A. moestus*. First six abdominal segments each with three annulets, seventh and eighth apparently with only two. Setal pattern similar to *A. laetus*, but lacking denticles present in *A. moestus*. Smaller than those of above two species, measuring only 7–8 mm when mature. Body bluish white; head shiny golden brown. Each abdominal sternum with about eight (or slightly more) setae.

Head (Fig. 17C)

About 1,25 times wider than long. Coronal suture as in *A. laetus* and *A. moestus*. Frons with transverse row of four setae near frontoclypeal suture, which is well defined; also with long seta on each side, laterad of antennal base. Epicranium with longitudinal row of three dorso-epicranial setae as well as one exterior dorso-epicranial seta on each side; anteriorly with single long seta near antennal base. Antennae slightly more than half the length of cranium, appearing four-segmented; the first and second segments almost immovably united; apical segment small, bearing at least one large sensory spot and some sensory pegs; penultimate segment also with sensory grooves on protuberance as in other species.

Labrum and clypeus

Two well-defined clithra present, dividing labrum into small median and two lateral lobes. Setal pattern of labrum as in *A. laetus*; also with two smaller setae near clypeal border. Clypeus slightly longer than the labrum, with same setal pattern as in latter species.

Epipharynx (Fig. 17E) very similar to that of *A. laetus* with same setal pattern; also with one or two strong setae in middle of dexiophoba. Tormae fairly symmetrically developed and crepis fairly distinct.

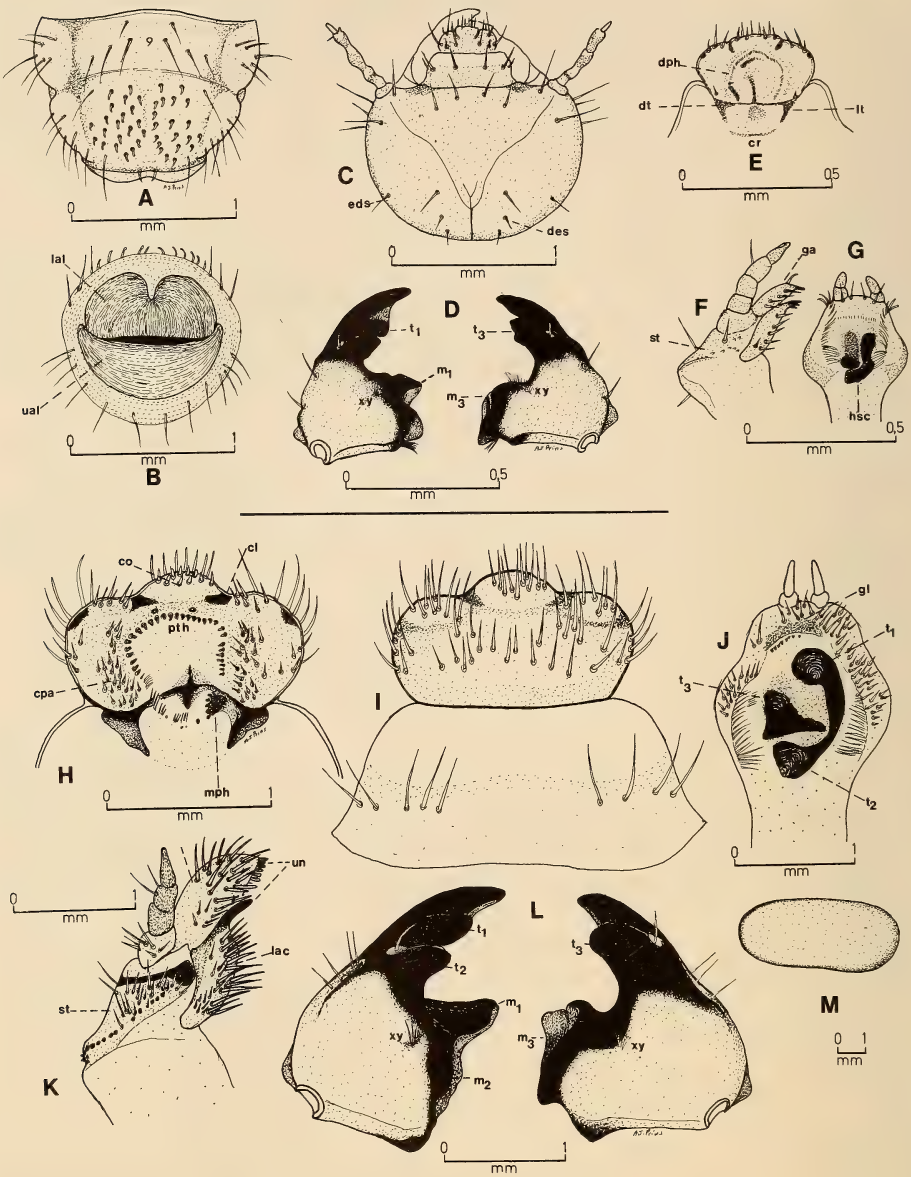

Fig. 17. Scarabaeidae. A–G. *Aphodius consimilis* larva. A. Apical abdominal segment, ventral view. B. Anal opening, viewed directly from the rear. C. Head, dorsal view. D. Mandibles, dorsal view. E. Epipharynx. F. Left maxilla, dorsal view. G. Hypopharynx.
H–M. *Onitis aygulus*. H–L. Larva. H. Epipharynx. I. Labrum and clypeus, dorsal view. J. Hypopharynx. K. Left maxilla, dorsal view. L. Mandibles, dorsal view. M. Egg.

Mandibles (Fig. 17D)

About 1,2 times wider than long. Rather similar to those of *A. laetus* (Fig. 15P), with neck very short and the lateral sides rounded. Dorsal carina rounded and scrobis indistinct. Three setae visible on dorsal side, of which one is situated on lateral face. Cutting edge of left mandible broad, scissorial notch clearly indicated. Second tooth (t_1) fairly blunt or rounded. Cutting edge of right mandible similar to that of *A. procerus*, but second tooth (t_3) broad and in some specimens almost bilobed. Molar areas similar to those of *A. laetus* and *A. procerus* (including dorsomolar setae). Both mandibles with brustia.

Maxillae (Fig. 17F)

Galea and lacinia free apically as in other *Aphodius* species; galea with a single uncus and dorsally with five setae. Ventrally galea bears longitudinal row of closely approximated setae as in *A. procerus* as well as a single seta on lateral margin near apex. Lacinia with three well-developed unci, of which distal one is largest, and single ventral seta, situated close to proximal uncus. Dorsally there are six strong setae near mesal margin. Stipes dorsally with row of about eight stridulatory teeth of which at least five are fairly conspicuous; two or more stridulatory teeth and single seta located near base of palpifer. In the other *Aphodius* species described here there are two setae in this position. Ventrally there are two setae as in *A. laetus*; four-segmented maxillary palp, including its setae, as in *A. laetus*. Labacoria dorsally bare, ventrally with two setae. Alacardo with a single seta.

Labium

Similar to that of *A. laetus* and *A. moestus*, but the postmentum with only one seta on each side.

Hypopharynx (Fig. 17G) similar to the other three species described above. Hypopharyngeal sclerite well developed, oncyli almost as in *A. procerus*. Lateral sclerites fairly well developed; transverse row of setae in front of the hypopharyngeal sclerite indistinct.

Ninth and tenth abdominal sterna (Fig. 17A)

Rather similar to those of *A. moestus*, the two segments clearly demarcated. *Raster* consisting of two tegilla, which are fused proximally but separated distally in some specimens. Each tegillum with twenty-three to twenty-five hamate setae; in old specimens each seta situated on tiny black tubercle as in *A. moestus*. Barbula absent. Anal lips (Fig. 17B) similar to *A. moestus*, but lower anal lip much larger and in most specimens slightly larger than upper anal lip.

Pupa

Similar to that of the other *Aphodius* species described here (including abdominal hooks), but smaller. Length 4,2–4,9 mm. Yellowish white in colour but becoming dark brown just before emergence of imago.

BIOLOGY

Aphodius consimilis is one of the most numerous scarabs found in fresh to semi-dry cow-dung in the southern and western Cape. It is usually associated with other species, such as *A. moestus*, *A. discoidalis*, *A. procerus*, etc. Larvae of this species were collected almost throughout the year, except in midwinter. The eggs resemble those of *A. moestus* and measure from 0,56 by 0,44 mm to 1,0 by 0,64 mm. They are slightly shiny, dirty white and almost transparent and, as in all other scarab eggs, they increase in size after oviposition. All eggs were laid in semi-fresh to semi-dry cow-pats, in groups of five or more, and were never found in fresh dung. When mature, the larva constructs a little clay cell in which the whitish prepupa and later the pupa is formed. If dung is still available, the cells are constructed in the remains of the pats, otherwise in the top layer of the soil. According to observations made the incubation period of the eggs seems to be the same as for *A. moestus*. The larval period occupied 19–25 days during August to September and the pupal stage 16–18 days. The whole life-cycle was completed in 35–47 days in specimens kept in the laboratory (16–22 °C). Newly-emerged beetles are straw coloured.

Onitis aygulus (Fabricius)

DESCRIPTION

Adult

Described by Peringuey (1901) and Skaife (1953). Thorax bronzy green, elytra more greenish brown. Similar to *Onitis caffer* in general form and shape. Elytra with seven distinct striae. Length varying from 18,3 to 23 mm.

Widely distributed in the western and north-western Cape; also present in South West Africa (Ferreira 1978).

Larva

Larva rather similar to that of *O. caffer*, as described by Oberholzer (1958). As only few mature specimens were available for study, it was difficult to determine exact number of annulets, but abdominal segments 1–6 appear to have three annulets and segments 7 and 8 only two. All annulets, except probably first two, with scattered setae and those on at least first three segments arranged in single transverse rows; spine-like setae occur on segments 3–10. Spiracles and legs as in *O. caffer*. Sterna almost devoid of setae, except tenth sternum.

Head

Similar to that of *O. caffer*. Fairly smooth and colour golden, yellow brown, marbled with iridescent pale blue on certain areas in some specimens. Ocelli absent. Antennae four-segmented; apical segment small and bearing sensory cones. As very few specimens were available, a reconstruction of the mouth-parts

was made from cast skins and compared with those that could be preserved for drawing.

Labrum and clypeus (Fig. 17I)

Differ from those of other scarab larvae described here by presence of large numbers of setae, particularly on labrum. Two clithra divide latter into three rounded lobes, each bearing large number of setae, which are also continuous on median area. Postclypeus bearing median transverse row of nine to ten long setae. Both the clypeus and labrum seem to agree well with those of *O. caffer*, but judging by the figures of Oberholzer (1958), labrum more setose in latter.

Epipharynx (Fig. 17H) rather similar to that of *O. caffer*, but acanthopariae seem to be represented by only two or three setae on each side. Each chaetoparia with at least twenty-two to twenty-six setae; acroparia with about six setae each; corypha with about twelve strong rounded spines. Posterior epitorma better developed than anterior one and two sensilla present anterior to protophoba. Mesophoba sclerotized on left side and forms part of laeotorma; lateral lobes each with small strongly sclerotized area. Fused tormae, and anterior and posterior epitormae fairly well developed. Otherwise as in *O. caffer*.

Mandibles (Fig. 17L)

Reddish brown, cutting and molar areas black. Only slightly longer than wide and nearly as long as cranium. Dorsal carinae rounded, scrobis indicated by short shallow depression with about four setae; also single curved seta present in middle of neck between teeth t_1 and t_2. Stridulatory areas absent on both mandibles. Judging by Oberholzer's figures, mandibles are fairly different from those of *O. caffer*. In *O. aygulus*, cutting edge of left mandible is clearly tridentate; scissorial notch fairly wide and distinct. On right mandible cutting edge is bidentate with wide and deep notch between first and second tooth (t_3). Molar area of left mandible clearly divided into proximal (m_2) and distal (m_1) lobe; latter long and broad. On right mandible division not so clear, molar area forming a wide tooth (m_3) ventrally. Short oblique row of fine dorsomolar setae (xy) present on each mandible.

Maxillae (Fig. 17K)

Rather similar to those of *O. caffer*. Galea and lacinia free, latter with single strong uncus, its mesal margin beset with strong setae. Ventral side of lacinia with numerous setae. Galea with very small uncus surrounded by curved row of about eight rounded spines, which continue as strong setae on ventral side. Whole of ventral area studded with hamate setae, its dorsal surface with numerous strong setae. Palpifer of three-segmented maxillary palp with about fourteen setae. Stipes with one long and some short ventral setae; dorsally with about eighteen setae and sixteen conical stridulatory teeth. Penultimate segment of maxillary palp with two setae on lateral margin.

Labium

Similar to that of *O. caffer*, palpi with apical segment fairly long.

Hypopharynx (Fig. 17J). Glossa with about ten hairs in middle and numerous setae on right side. Left side with only two setae in specimens examined. Right lateral sclerite with numerous spine-like setae; left one with only twenty to twenty-two spine-like setae. Oncyli on right side with two well-developed teeth (t_1 and t_2); third tooth (t_3) more weakly developed.

Ninth and tenth abdominal sterna (Fig. 18C)

Rather similar to those of *O. caffer*. The two sterna clearly demarcated. The two palidia long, each with eighty-seven to ninety-two pali, anterior third separated from the rest. Tegilla as in *O. caffer*, each one with numerous palus-like setae. Septum long, somewhat wider posteriorly. Anal lips similar to those of the latter species.

BIOLOGY

Skaife (1953) describes the biology of *Onitis aygulus* and according to him the beetle first digs a tunnel in the soil beneath the dung. At the bottom of this tunnel a large chamber is excavated into which a mass of dung is carried and in this mass the eggs are deposited at intervals as the filling of the chamber proceeds. The cells in which the eggs are laid are always made near the surface of the dung.

About six white, oval eggs (Fig. 17M) are laid and these hatch within about 14 days. When fully grown each larva makes a cell in which pupation occurs. The pupal stage lasts 14–21 days.

In sandy areas along the west coast, the oblong whitish eggs of this species were often observed in semi-fresh cow-pats during January. Fairly large larvae (about 35 mm long) that hatched from such eggs were collected from hollowed-out chambers in the pats in the same areas during the end of January and beginning of February. Pupae from these larvae were about 16 mm long, pale lemon yellow, and remained in the cells for about 38 days during September before the beetles emerged. Under such conditions larval stages lasted for about 202 days before pupation occurred and the newly-emerged beetles were reddish brown on the thorax with yellowish elytra and reddish legs.

Oniticellus pictus (Hausmann)

DESCRIPTION

Adult (Fig. 18A)

Previously described by Peringuey (1901). Length 6,4–8,7 mm. Pale yellowish or flavous with large black triangle on head, large black patch on pronotum and some black spots on elytra. Pronotum broader than elytra with conspicuous pits which are usually obsolete on central part; also small black spot on each side of pronotum. Legs flavous, marked with black.

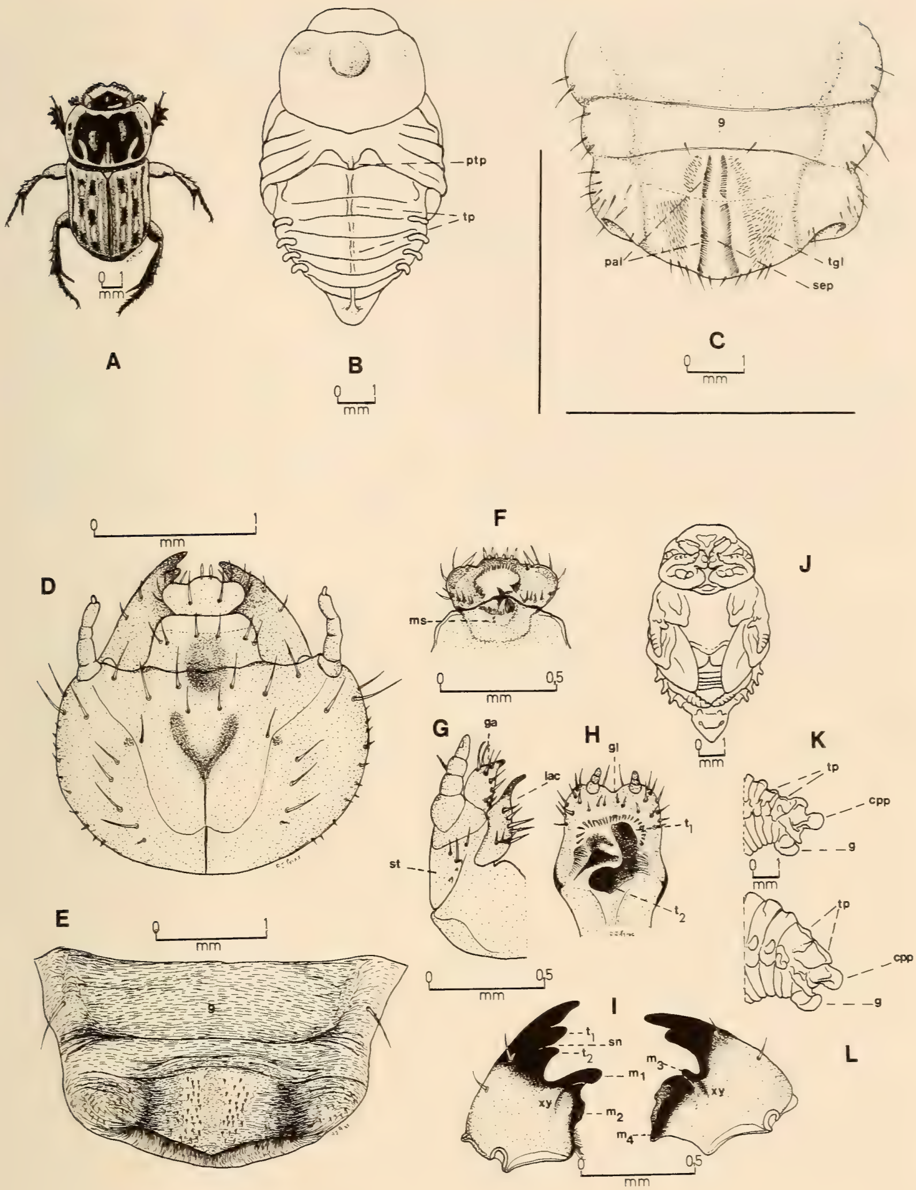

Fig. 18. Scarabaeidae. A. *Oniticellus pictus* adult. B. *Oniticellus pictus* pupa, dorsal view. C. *Onitis aygulus* larva, apical abdominal segments, ventral view. D–K. *Oniticellus pictus*. D–I. Larva. D. Head, dorsal view. E. Apical abdominal segments, ventral view. F. Epipharynx. G. Left maxilla, dorsal view. H. Hypopharynx. I. Mandibles, dorsal view. J. Pupa, ventral view. K. Apex of pupa, left lateral view. L. *Oniticellus planatus*, apex of pupa, left lateral view.

Attracted to fresh and semi-fresh cow-dung as in the case of *Oniticellus planatus*. Widely distributed in South Africa; also present in Zaïre and east Africa (Janssens 1953).

Larva

Very similar to that of *O. planatus* (Fig. 19C), but smaller. Abdominal segments 5–8 with two rows of dorsal setae; fourth segment dorsally with short spines only. Prothoracic shield angular on each side, but not toothed.

Head (Fig. 18D)

Only slightly wider than long, similar to that of *O. planatus* and having same depressions. Frons with transverse row of four setae near clypeofrontal suture and posterior to this two smaller paramedian setae; also single seta present on each side near middle of frontal suture. Single seta present just mesad of each antennal base. Epicranium anteriorly with three setae and posteriorly with longitudinal row of four to five setae as in *O. planatus*. Sides of epicranium with very small setae.

Labrum and clypeus

Labrum about twice as wide as long with the same number of setae as in *O. planatus*. Clypeus also twice as wide as long, about one-third longer than labrum and with two long paramedian setae and two lateral setae on each side.

Epipharynx (Fig. 18F) very similar to that of *O. planatus* but clithra not sclerotized. In mature larvae corypha and lateral lobes strongly sclerotized, as well as anterior and posterior epitormae. In all specimens examined each acroparia with one seta. Mesophoba in most specimens seen with long setae. At least one pair of macrosensilla clearly visible in most specimens.

Mandibles (Fig. 18I)

Slightly more than half the length of cranium. Dorsal carina rounded and scrobis indistinct and, as in *O. planatus*, with only two setae dorsally. Cutting edge of left mandible with three teeth, scissorial notch distinct. Molar area divided into two lobes; distal one (m_1) long, broad and emarginate in middle; proximal lobe (m_2) as in *O. planatus*, with a fringe of hairs posteriorly. Right mandible similar to that of *O. planatus*, but molar area with strong ridge (m_3) anterior to it. Each mandible also with longitudinal row with fine dorsomolar setae.

Maxillae (Fig. 18G)

Similar to that of *O. planatus*. Galea with single short uncus, dorsally with seven setae, ventrally beset with about twenty-five setae on mesal area. Lacinia with single long uncus and eight strong setae dorsally; ventrally with five to six setae of which the apical one is very short and spine-like in young specimens.

Labacoria ventrally with two small setae; dorsally bare. Alacardo with about three setae. Stipes ventrally with two setae and dorsally with three of which posterior one is longest. Three inconspicuous stridulatory teeth also present. Palpifer with two setae situated close together ventrally; penultimate segment of maxillary palp with single long seta on the ventral side and one on lateral margin.

Labium

Postmentum trapezoidal; in mature specimens anterior part with broad rounded ridge bearing only two short setae near base. Proximal sclerite of prementum convex, transversely divided by shallow notch into two halves, each with three setae, inner ones longest. Distal sclerite of prementum divided by depression into two globular lobes, each with ten to twelve setae.

Hypopharynx (Fig. 18H). Glossa deeply cleft by depression into two halves, each with five to seven setae; oncyli forming two strong teeth on right side, as in *O. planatus*; left one with transverse tooth. Oncyli anteriorly encircled by a row of strong setae in front of which there is transverse row of six setae. Each lateral sclerite with row of fine hairs laterad of oncyli.

Ninth and tenth abdominal sterna (Fig. 18E)

Ninth and tenth segments clearly demarcated. *Raster* similar to that of *O. planatus*, but iridescent areas oblong and narrow, beset on each side with twenty to thirty tiny black tubercles, each with tiny hamate seta. Tenth sternite in form of wide V-shaped lip just below lower anal lip (in *O. planatus* it is widely convex, not V-shaped); otherwise as in the latter species. Barbula absent. Lateral areas of tenth segment beset with small setae.

Pupa (Fig. 18B, J–K)

Almost pure white when formed, but turning darker as imago develops. Length about 10 mm and, as in *O. planatus*, prothorax with large convex median raised area and inconspicuous swelling on each pronotal shoulder. Abdomen with four lateral projections, as well as pteronotal, dorsal tergal, and caudal support projections (ptp, tp and cpp). Extreme apical part of dorsal projection, as well as caudal projection and developing genital capsule fairly rounded so that there appear to be three rounded knobs on abdominal apex (in *O. planatus* there are only two which are fairly rounded, extreme apical part of caudal support projection not rounded but carinate).

BIOLOGY

As in *Oniticellus planatus,* the full-grown larvae of *O. pictus* are found in oval clay cells somewhat smaller than those of the former species, i.e. 10–11 mm in diameter. Prepupae and pupae are almost pure white and were collected during March and April together with those of *O. planatus* in the same cow-pats. Beetles emerged during April. Both these species seem to play an important part in the destruction of the dung, as large numbers of pupal cells were collected per

cow-pat in certain areas around Mossel Bay and in the Brandwag area between Mossel Bay and Oudtshoorn.

Oniticellus planatus Castelnau

DESCRIPTION

Adult (Fig. 19A)

Previously described by Peringuey (1901). Shiny black, elytra longitudinally striate, each stria with one row of punctures. Prothorax somewhat wider than elytra. Length 9,9–10,9 mm. Attracted to fresh and semi-fresh cow-dung and very numerous in the Mossel Bay area during the surveys. Widely distributed in Africa (Peringuey 1901; Janssens 1953).

Larva (Fig. 19C)

White in colour. Only pro- and mesothoracic segments with dorsal setae; metathoracic segment almost devoid of setae. Abdominal segments 3–7 with scattered setae dorsally; segments 8–9 apparently with two rows of setae; second abdominal segment with one row of setae dorsally. Legs with some setae, mostly on ventral side, coxae almost devoid of hairs; claws absent (Fig. 19H), but there is short terminal seta surrounded by circle of six to eight hairs. Prothoracic shield with transverse ridge on each side which is somewhat pointed in middle, but lacking triangular projections as in *Onitis caffer* (Oberholzer 1958). Spiracles as in *O. caffer* and with fairly long seta posterior to each spiracle.

Head (Fig. 19E)

Only slightly wider than long, frontal suture forming an inverted M, with arms not very clearly indicated anteriorly. Coronal suture extended to middle of cranium where it joins V-shaped notch or depression. Depression on fronto-clypeal suture extending on to posterior half of postclypeus. Frons with three long setae on each side as illustrated, two of which are situated medially, one on either side of depression near clypeal border; another pit present exterior to each of these setae. Epicranium with seven to eight dorsal setae on each side of which four are situated in longitudinal row near the frontal suture on a narrow area that is lighter in colour than rest of the cranium.

Labrum and clypeus

Labrum slightly less than twice as wide as long and deeply emarginate on each side of corypha; lateral lobes rounded. Middle lobe with about seven to eight strong setae; lateral lobes with four strong setae, the posterior two sickle-shaped; there are also two paramedian setae. Clypeus only slightly longer than labrum, with two lateral setae on each side and two paramedian setae on postclypeus.

Epipharynx (Fig. 19J). Clithra well developed and corypha with four strong, rounded spines. Each chaetoparia with eight setae and each acroparia represented by two strong setae. Pedium raised above level of lateral lobes and encircled

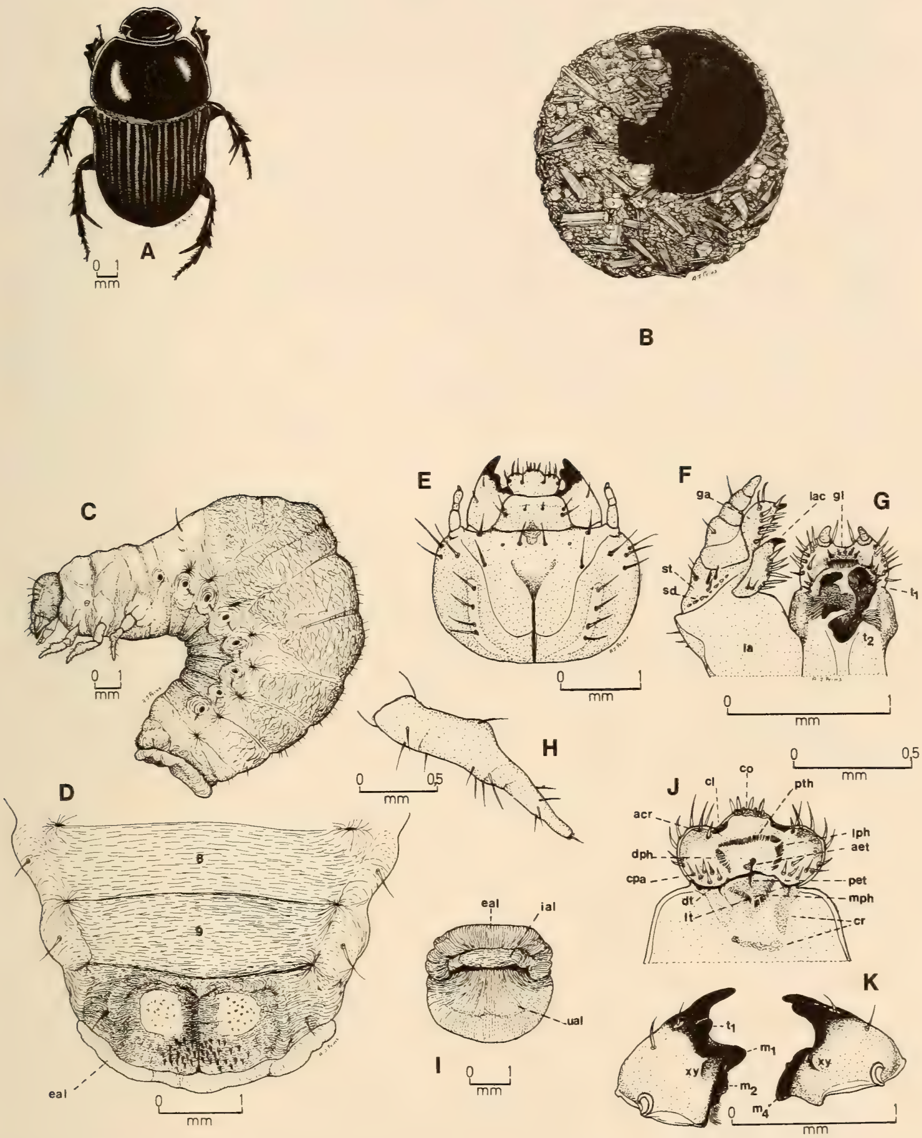

Fig. 19. Scarabaeidae. *Oniticellus planatus*. A. Adult. B. Clay cell. C–K. Larva. C. Left lateral view. D. Apical abdominal segments, ventral view. E. Head, dorsal view. F. Left maxilla, dorsal view. G. Hypopharynx. H. Right mesothoracic leg. I. Anal opening, viewed directly from the rear. J. Epipharynx. K. Mandibles, dorsal view.

by dexio-, laeo- and protophobae. Tormae (dt and lt) present as narrow sclerite; both anterior and posterior epitormae present. Crepis represented by three weakly sclerotized areas. Anterior half of area enclosed by crepis (haptolachus) raised; upper surface almost flat and surrounded by mesophoba.

Mandibles (Fig. 19K)

Slightly more than half the length of cranium; dorsal carina rounded; only two dorsal setae present and single ventral seta near molar area. Scrobis indistinct and stridulatory area absent. Distal cutting edge of left mandible narrow, scissorial notch in form of wide depression between apical tooth and molar area; also single small tooth (t_1) present below apical tooth. Molar area bilobed, distal tooth (m_1) broad and fairly sharp; proximal lobe (m_2) with arcuate posterior margin, bearing setae. Right mandible with two fairly rounded apical teeth, scissorial notch shallow. Molar area consisting of single broad oblique lobe that forms fairly strong tooth (m_4) pointing backwards; ventral tooth separated only at posterior end. Molar area on each mandible with small groove on dorsal side bearing fine dorsomolar setae.

Maxillae (Fig. 19F)

Galea and stipes free, each with single short uncus. Galea on dorsal side with about seven setae, and ventrally with twenty to thirty long setae on mesal side. Lacinia dorsally with about eight strong setae and ventrally with about five. Stipes dorsally with four setae as well as row of about eight small stridulatory teeth. Palpifer with two exterior setae and one long ventral seta. Penultimate segment of maxillary palp with single exterior and single ventral seta. Labacoria bare, except for two small ventral setae; alacardo with about four setae.

Labium

Distal sclerite of prementum divided by a depression into two almost conical halves, each bearing ten to twelve setae. Proximal sclerite of prementum convex and bearing median transverse row of six setae. Postmentum trapezoidal with two short setae near base.

Hypopharynx (Fig. 19G). Glossa widely emarginate apically, each half bearing about eight strong setae; hypopharyngeal sclerite strongly sclerotized, oncyli forming at least two strong conical teeth (t_1 and t_2). That part of glossa in front of oncyli strongly sclerotized, forming ridge bearing fine hairs. Anterior to this sclerotized area there is transverse row of about five short spine-like hairs. Longitudinal row of four spine-like setae present on each lateral side of oncyli.

Ninth and tenth abdominal sterna (Fig. 19D)

Ninth and tenth segments clearly divided, with inconspicuous, longitudinal ridge on tenth sternite, ending in front of lower anal lip in small V-shaped notch.

On either side of this ridge an almost oval iridescent bluish patch present and posterior to this a small tegillum bearing about twenty short, palus-like setae. Single long setae situated laterad of each iridescent patch, as well as some smaller scattered hairs. Anal opening transverse, surrounded by large upper anal lip (Fig. 19I) and smaller lower lip, divided into exterior and interior lobe. Barbula absent.

Pupa

Very similar to that of *O. pictus* and when newly formed almost pure white, but as imago develops it turns darker. Most of pupae collected range in length from 12 to 13 mm. Extreme apex of abdomen with two swellings, the dorsal one being the caudal support projection and the lower one the developing genital capsule (Fig. 18L). Longitudinal ridge or dorsal tergal support projection more or less carinate and obsolete on segments 4–7.

BIOLOGY

The creamy-white, almost pear-shaped eggs of *Oniticellus planatus* are laid singly in a small dung ball, 14,5–15 mm diameter, in which the larva feeds. When fully grown a clay cell (Fig. 19B) of similar size and shape is constructed from remains of the original ball, in which the prepupa and later the pupa is formed. When turning into prepupae the larvae become almost pure white, except for the mandibles, which are black. Pupal cells were collected during March and beetles emerged during April.

Newly-emerged beetles are light brown on elytra; the pronotum, head and legs pale chocolate brown and rather shiny. Up to fifteen pupal cells were collected from a single cow-pat, usually in association with *O. pictus*.

Pachnoda sinuata (Fabricius)

DESCRIPTION

Adult (Fig. 20C)

Yellowish beetle with dark-green coloration on pronotum and elytra. Ventral side of body yellow with red and white on sides and about six oval spots on maroon-coloured apex of abdomen; also two white spots on ventral side of abdominal apex. Head dark brownish with two long yellowish patches on each side of clypeus and two oval white spots above eyes. Length about 25 mm. A variable species of which several varieties have been described.

According to Peringuey (1907) *Pachnoda sinuata* is widely distributed in central, eastern and southern Africa. It seems to be fairly well represented in the western Cape Province, especially in the fruit-producing areas from Worcester to Somerset West, and has also been collected at Elands Bay. This contradicts Donaldson's (1979) statement that it does not occur in the south-western Cape.

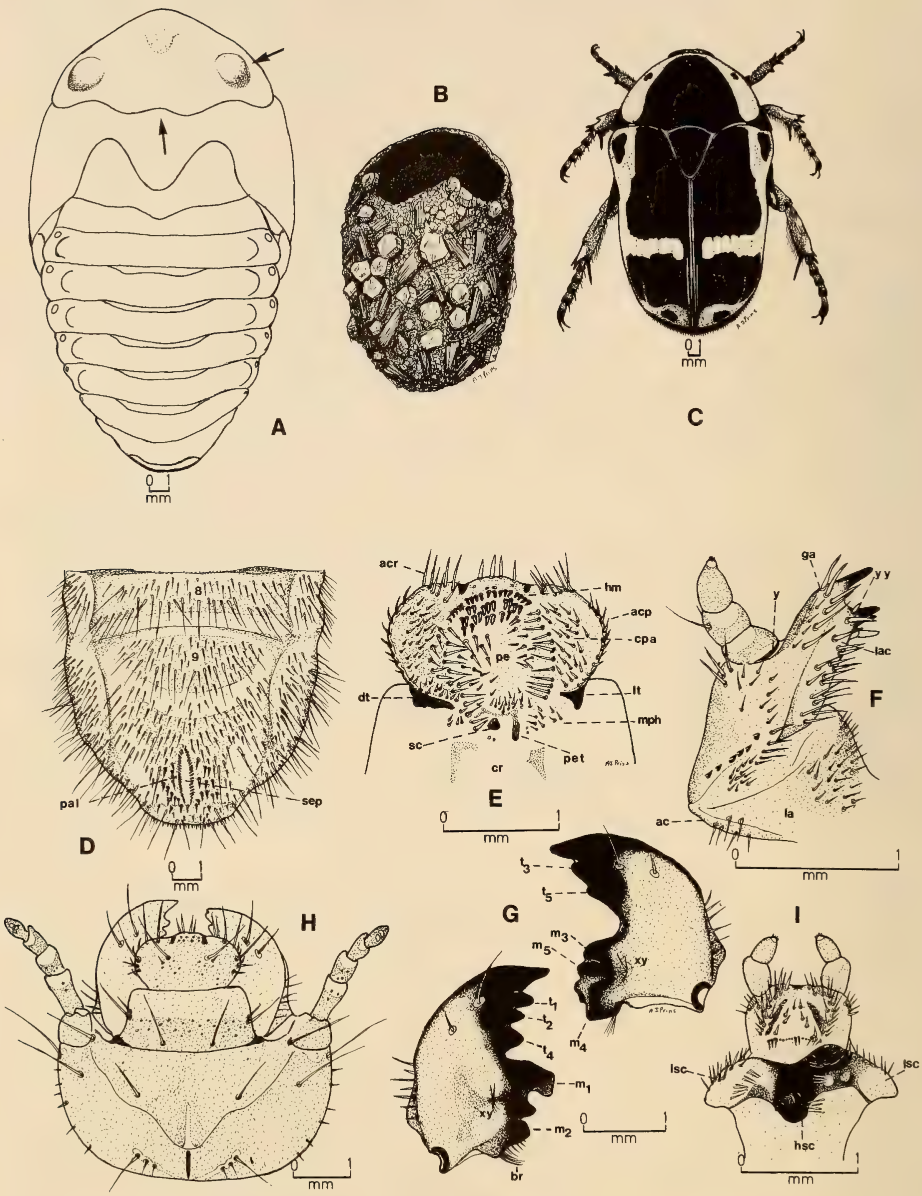

Fig. 20. Scarabaeidae. *Pachnoda sinuata*. A. Pupa, dorsal view. B. Clay cell. C. Adult. D–I. Larva. D. Apical abdominal segments, ventral view. E. Epipharynx. F. Left maxilla, dorsal view. G. Mandibles, dorsal view. H. Head, dorsal view. I. Hypopharynx.

It is fairly common around Milnerton, Pinelands, and even Beaufort West and Kuruman.

Larva

Very similar to that of *Rhinocoeta cornuta* (Fabricius) (Fig. 21D) in length, form and shape, but slightly more hairy on ventral side. Colour of hairs fulvous. Legs also similar to those of *R. cornuta*. As in the case of the latter species, they are able to stretch their bodies fully when walking.

Head (Fig. 20H)

About twice as wide as long, frontal sutures clearly indicated; anterior extension of coronal suture in most specimens visible as a paler, narrow area. Ocelli obsolete or faintly visible in some specimens as paler area just behind antennal bases. Cranium not marbled, or very weakly so; setal pattern almost same as that of *R. cornuta*. Antennae about as long as cranium, four-segmented; apical segment with five oval sensory spots as well as terminal spot with sensory pegs; penultimate segment also with sensory spot. First and second antennal segments each with three to four small pits. As in *R. cornuta*, antennae are bare, without any setae.

Labrum and clypeus

Labrum nearly twice wider than long; clearly divided into a median and two lateral lobes. Setal pattern almost the same as in *R. cornuta*, but with some short slender setae instead of short spine-like setae on its posterior half. Clypeus about twice as wide as long and also with same setal pattern as in latter species; postclypeus also pitted.

Epipharynx (Fig. 20E) very similar to that of *Pachnoda impressa* (Goldfuss) (Oberholzer 1959) and *R. cornuta*, and with about ten strong heli on haptomerum; pedium with about twenty strong setae in anterior area, which are almost as strong as heli; two chaetopariae with fewer setae than in *R. cornuta*; each acroparia with about ten strong setae; crepis represented by two slightly sclerotized plates. Otherwise as in *R. cornuta*, except anterior epitorma not so clearly visible as in latter species and two pairs of macrosensilla transversely arranged in most specimens examined.

Mandibles (Fig. 20G)

Very slightly longer than cranium and about 1,25 times longer than wide. Rather similar to those of *R. cornuta*, but more robust, apical tooth shorter, particularly on right mandible. Dorsal carina rounded, scrobis obsolete and represented by two pits, as in latter species, each with seta, distal one longest; lateral face with about seven setae; brustia as in *R. cornuta*. Stridulatory area present ventrally on both mandibles. Cutting edges of both mandibles similar to those of latter species, but second tooth (t_1) on left mandible more acute. As in

R. cornuta, a depression present laterad of molar area on each mandible, bearing about eight fine dorsomolar setae. Otherwise exactly as in *R. cornuta*.

Maxillae (Fig. 20F)

Very similar to those of *R. cornuta*. Lacinia and galea fused, demarcating suture visible dorsally but totally absent on ventral side and separated by strong sclerotization, part of which is also visible on lateral margin. Galea as in *R. cornuta*; single uncus present. Dorsally with about six strong setae and about seven weaker ones exterior to these. On ventral side distally with eight or nine setae, proximally with only two to three.

Lacinia with two unci, dorsal one with strong spine (yy) at base, which is more obvious than in *R. cornuta*. Mesal margin of mala beset with numerous strong setae or spine-like setae, those bordering unci much more strongly developed. Stipes ventrally with single long setae near base and distally with about three setae on palpifer; latter not clearly demarcated. Dorsally with some fine setae (about twenty-eight or more) and row of six stridulatory teeth of which distal one is almost rounded, others acute. Otherwise as in *R. cornuta*. Maxillary palp with three distinct segments and basal or fourth segment represented only by narrow sclerotized plate (y). Penultimate segment with single ventral and lateral seta. Sensory spot not obvious on apical segment.

Labium

Very similar to that of *R. cornuta* and with the same setal pattern. Postmentum, however, more rectangular. Labial palps as in latter species, with sensory pegs at apex.

Hypopharynx (Fig. 20I) very similar to that of *R. cornuta*, and with almost similar setal pattern. However, lateral sclerites less sclerotized in most specimens seen and small tubercles or sensory pegs form transverse row in front of hypopharyngeal sclerite; in *R. cornuta* these are more scattered, forming somewhat curved row.

Ninth and tenth abdominal sterna (Fig. 20D)

The two segments fused with no demarcation line between them on ventral side. *Raster* as in *R. cornuta*, except that there are more palus-like setae on each tegillum and palidia are almost parallel, each one containing twenty-four to twenty-six pali. Septum thus formed is long and narrow and usually wider in middle. Anus and anal lips similar to *R. cornuta*.

Pupa (Fig. 20A)

Also similar to that of *R. cornuta*; yellowish brown, but becoming darker as imago develops. Length 23–25 mm. Apart from differences in developing genital capsule, pupa of *Pachnoda sinuata* is easily distinguished from that of *R. cornuta* by absence of prothoracic horn and by sinuate hind margin of pronotum (almost straight in *R. cornuta*). Each posterolateral angle of pronotum bears large

rounded tubercle or knob (absent in *R. cornuta*, and represented only by two oval folds).

BIOLOGY

In the western Cape Province larvae of *Pachnoda sinuata* are commonly found in compost heaps, particuarly in the Milnerton, Pinelands and Somerset West areas. Large numbers of fairly small and fully mature larvae and pupae were found during the early winter (April, May) and beetles started to emerge from about midwinter. However, during the surveys large numbers of larvae remained in the soil in clay cells until the early spring when pupae were formed, the beetles emerging from September to November. These surveys indicated that beetles appear from late autumn to midwinter in the eastern and western Cape as well as in Natal; the peak period of emergence in the western Cape Province, however, occurred from early spring to late summer.

The larvae feed on organic material in compost heaps or other suitable accumulations of decaying organic matter and when fully mature they construct hard, oval clay cells, 25–30 mm long (Fig. 20B), in which the prepupal and later the pupal stages are formed. In some instances larvae collected remained for nearly a month in the prepupal stage before pupation occurred. Pupal stages lasted for 30–44 days in the laboratory at an average temperature of about 22 °C.

The newly-emerged beetle is pale yellow, marbled with dark green, the head and pronotum reddish; the ventral side is also pale yellow and reddish. However, after a few hours to about a day they assume their normal coloration, which is somewhat darker.

The rearing of *Pachnoda sinuata* larvae in the laboratory is described by Donaldson (1979).

Rhinocoeta cornuta (Fabricius)

DESCRIPTION

Adult (Fig. 21A)

Black, pitted all over (particularly pronotum) with setigerous punctures; areas between punctures shiny, except for the longitudinal matt strips on elytra. A tubercle or triangular tooth present medially on anterior margin of pronotum and behind this tubercle usually a wide depression. Legs, ventral side of thorax and head covered with long golden or fulvous hairs. Length 17–20 mm. For further details see Peringuey (1907).

Widely distributed in southern Africa (Schein 1960); abundantly found along the south coast of the Cape Province during present surveys.

Larva (Fig. 21D)

Mature larvae measure about 45 mm in length. Colour is whitish pink to pale pink, with reddish-brown to light-reddish head. Legs yellow; prothoracic shield yellowish brown; latter not angled or toothed in front. All spiracles cribriform,

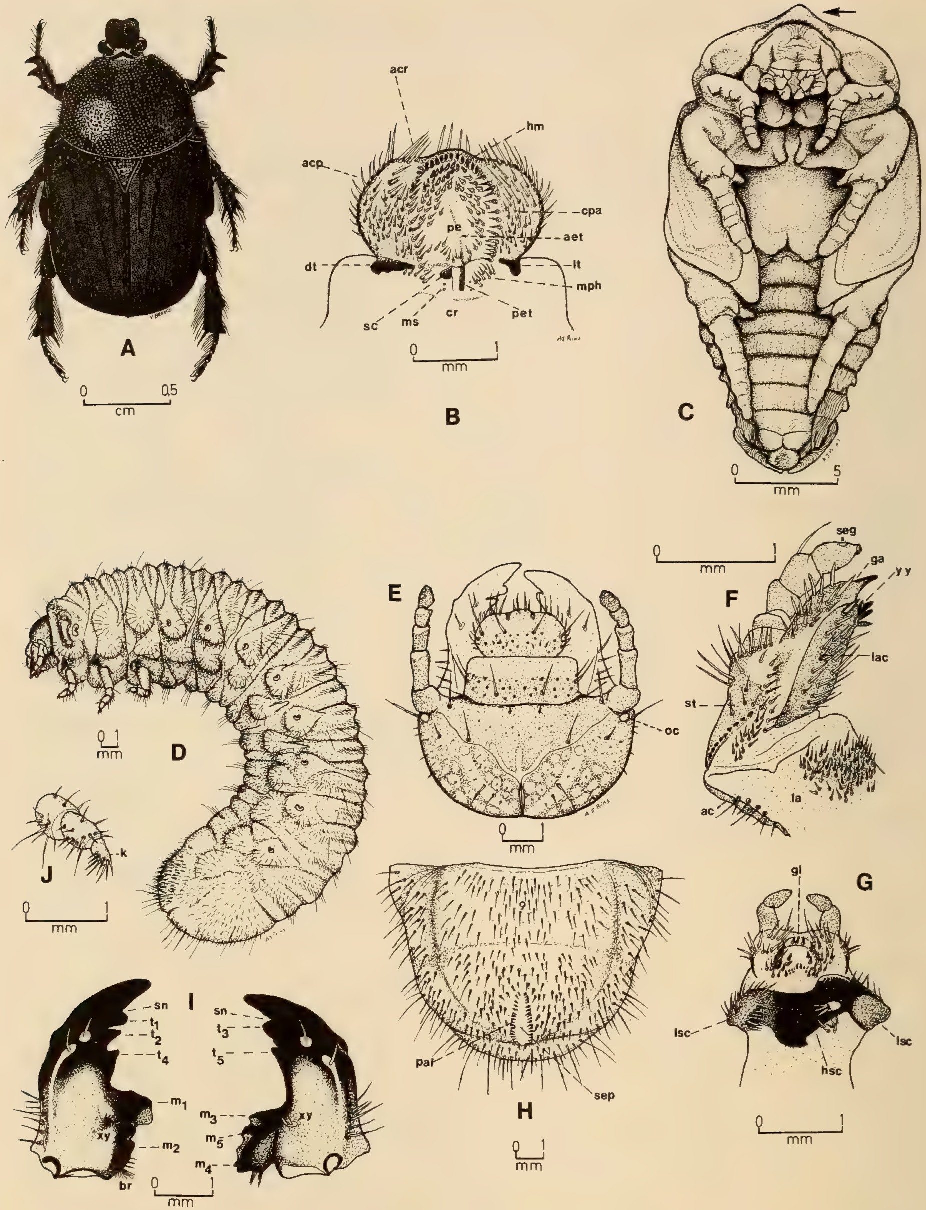

Fig. 21. Scarabaeidae. *Rhinocoeta cornuta*. A. Adult. B. Epipharynx of larva. C. Pupa, ventral view. D–J. Larva. D. Left lateral view. E. Head, dorsal view. F. Left maxilla, dorsal view. G. Hypopharynx. H. Apical abdominal segments, ventral view. I. Mandibles, dorsal view. J. Right mesothoracic leg.

with concavities pointing as illustrated; thoracic one largest. First seven abdominal segments with three annulets, eighth with two. Each annulet with broad band of long spine-like setae. Ninth and tenth terga almost completely covered with spine-like setae; also some long hairs present. Sterna of abdominal segments 1–8 with row of long hairs and also some shorter spine-like setae; colour of body hairs fulvous. Legs well developed and more or less of same size; claw of tarsungulus (Fig. 21J) rounded, fleshy, distally obtuse and surrounded by about ten strong setae.

The larvae are able to stretch their bodies fully when walking and when disturbed they usually turn on their backs and slide away from danger.

Head (Fig. 21E)

Slightly wider than long; brownish, smooth; epicranium almost marbled. Frontal sutures fairly distinct; coronal suture extended anteriorly as paler area, which sometimes has short branches lying next to frontal sutures. Ocelli present and clearly visible. Frons with one long seta on each side in most specimens seen, and two short spine-like paramedian setae just behind frontoclypeal suture, which is well demarcated; in older specimens with some tiny scattered pits. Also long seta present on each side near middle of frontal suture. Epicranium with two long setae dorsally near each ocellus; dorso-epicranial setae represented on each side by one long and two or more spine-like setae forming longitudinal row surrounded by a narrow paler area, which is not marbled; also some scattered pits, each with short spine-like seta, which are absent in young specimens. Antennae almost as long as cranium, four-segmented and in most specimens seen without any setae. Apical segment with one small round and five large oval sensory spots as well as terminal sensory spot with sensory pegs; penultimate segment also with sensory spot.

Labrum and clypeus

Labrum slightly more than half the length of cranium; divided by two clithra into one median and two lateral lobes. Median lobe with four dorsal setae and each lateral lobe with about four strong anterior setae and a long posterior one. Also two long paramedian setae, and in addition some short spine-like setae on posterior part of labrum. Clypeus about same length as labrum, with one long and one short seta on each side, as well as two long paramedian setae near posterior border. Postclypeus abundantly pitted.

Epipharynx (Fig. 21B). Corypha with four strong setae; haptomerum developed and strongly sclerotized in old specimens. Ten to twelve strong heli present, situated in a curved row and extended on each side as a curved row of strong setae that encircles pedium. Latter large, oval, its central area with strong setae, which are palus-like in front and more weakly developed posteriorly. Chaetoparia well developed on each side; each acroparia represented by fourteen to sixteen strong setae; acanthoparia with twelve to fourteen sickle-shaped setae, last two on each side very small and spine-like. Tormae asymmetrically

developed, dexiotorma being largest. Epitormae almost obsolete. Crepis very weak, area enclosed (haptolachus) with conical sensory cone as well as elongate plate, which is part of posterior epitorma; fused tormae and anterior epitorma evident in some specimens examined. Two pairs of macrosensilla longitudinally arranged. Mesophoba forms continuation of setae encircling pedium and consisting of ten to fourteen fine setae on left side; on right side only about eight setae present of which inner four to five are stronger developed and spine-like.

Mandibles (Fig. 21I)

Mandibles long and narrow (length almost twice width) and somewhat longer than cranium. Dorsal carina rounded; scrobis weakly developed and almost obsolete in some specimens, only indicated by two depressions, each bearing short seta. Six to eight setae also present on each lateral face. About three small setae (xy) present laterad of molar area, those on left mandible in small depression. Stridulatory area present ventrally on both mandibles.

Cutting edges of both mandibles fairly narrow and pointed, that of left mandible with second tooth (t_1) rounded, scissorial notch not clearly demarcated in old specimens; third tooth (t_2) more acute, separated by deep notch from second. Fourth tooth (t_4) broad, situated in neck of mandible between cutting and molar areas. Second tooth (t_3) on scissorial area of right mandible fairly broad; scissorial notch obsolete in old specimens; third tooth (t_5) in neck, small and fairly rounded in some young specimens, more acute in older ones.

Molar area of left mandible clearly divided into proximal (m_2) and distal area (m_1); latter broad and forming round lobe-like tooth on ventral side; proximal area semi-circular posteriorly, with large brustia. Molar area of right mandible appears trilobed with deep notch between first (m_3) and second (m_5) and also between second and posterior tooth (m_4). Hind tooth broad posteriorly and divided by wide concavity into a large dorsal and smaller, more acute ventral tooth.

Maxillae (Fig. 21F)

Galea and lacinia fused but clearly divided by suture on dorsal side. Galea with single strong uncus, dorsal surface beset with about twenty-two setae, most of which are strong and spine-like, particularly those near uncus. Ventral side with strong spine just below uncus on mesal side and also about seven strong setae. Lacinia with two unci of which ventral one is smallest; also small spine (yy) at base of dorsal uncus. Mesal margin of mala beset with numerous strong setae, of which two are in form of stout spines, one on each side of the two unci. Stipes dorsally with medium-sized strong setae, particularly on lateral margin, and with about twelve stridulatory teeth. Ventrally with about eight strong setae distally and proximally only single strong seta present. Palpifer without any setae. Maxillary palp four-segmented; first segment small and only visible on exterior side; penultimate segment with one ventral and one lateral seta; apical segment coni-

cal, with sensory pegs at extreme apex and sensory spot laterally. Labacoria sclerotized and beset with fine setae on both sides; alacardo with six to eight setae.

Labium

Distal sclerite of prementum not clearly divided into two lobes and with two paramedian setae. Proximal sclerite of prementum slightly convex, with two paramedian setae. Postmentum trapezoidal, with single short seta near each posterior corner; posterior half pitted in old specimens.

Hypopharynx (Fig. 21G). Glossa beset on each lateral third with numerous setae, those near anterior lateral corners continuing around palpal bases and almost encircling labial palpi. In some specimens, sides of median third of glossa sclerotized; area in between with three strong spines anteriorly; posteriorly on each side also with about five strong spines and some finer setae, as well as two median strong spines and about ten tubercles or sensory pegs. Transverse sclerite strongly developed, asymmetrical and with strong conical tooth on the right as well as weakly sclerotized area with three or four setae. Lateral sclerites strongly developed; left one with setae on its lateral and inner margin, right one with setae only on lateral margin.

Ninth and tenth abdominal sterna (Fig. 21H)

Boundary line between the two sterna hardly visible. Both sterna completely covered with medium-long, spine-like setae present both ventrally and laterally. *Raster*: campus occupied by tegillum; teges separated by two palidia, each consisting of eighteen to twenty-two short pali; septum thus formed wider posteriorly; same short palus-like setae flank each palidium. Anal opening transverse; lower anal lip small, not divided. Transverse row of short setae present on either side of anal slit, which is not visible when viewed from the ventral side.

Pupa (Fig. 21C)

Castaneous brown, first five abdominal segments yellow. However, a few days before imago emerges, it turns to a dark, almost black colour. Length 21–25 mm. Body almost devoid of setae. Abdominal terga 1–5 with a swelling on each side. Characteristic conical, median swelling present behind head on front margin of pronotum, clearly visible in figure.

BIOLOGY

The eggs of *Rhinocoeta cornuta* are laid during the summer and early autumn and the larval stage lasts throughout the winter. Mature larvae were already present in midwinter and those observed during the survey hibernated in the soil, pupating in the early summer. The larval stage therefore lasts at least 10 months or more. Observations made along the south coast showed that the larva at first feeds in the cow-pats and, as it grows bigger, constructs a tunnel in the soil below

the pats into which it retreats, only coming up to feed. At first it is bluish white in colour, but when fully grown it turns pinkish or slightly crimson and is then 40–45 mm long. Larvae collected in June constructed clay cells of about 25 mm diameter in October, in which they transformed to the prepupal stage. This stage is characterized by its dirty-white colour and wrinkled appearance, and lasts for at least 21 days, pupae appearing from about November to January and beetles emerging from early December to almost the middle of February. The pupal stage lasts for 25–27 days.

The newly-emerged beetle is light brown on the thorax, with yellow elytra and abdomen. After about 2 days the thorax becomes black and the elytra reddish brown and after about 3 days the beetle assumes its normal colour.

Temnorrhynchus retusus (Fabricius)

DESCRIPTION

Adult (Fig. 14E)

Light brownish red to dark brown in colour, shiny, to slightly shiny; elytra almost smooth, pronotum fringed with golden hairs, and with fairly large, shallow pits divided over middle of disc by a narrow glabrous band in most specimens seen; often with anterior median area of pronotum hollowed out or depressed. This beetle is easily recognized by the oval flat rugulose or reticulate-rugulose disc on the head, the edges of which are almost trenchant in some specimens. Length varying from 14 to 21 mm.

Widely distributed in South Africa and South West Africa (Endrödi 1960).

Larva (Fig. 22A)

Yellowish white in colour. Larva of *Temnorrhynchus retusus* rather similar to that of *T. coronatus* as described and figured by Oberholzer (1963). Thoracic and eighth to tenth abdominal terga with long slender setae, those of abdominal segments 1–7 also with short spine-like setae. All abdominal spiracles of about same size, that of prothorax slightly larger. Legs increasing in length from front to back, well developed; tibiae of the first two pairs somewhat tapering towards their apices, those of the hind pairs convex below, not straight (Fig. 22D). Claws of first two pairs (Fig. 22C) long, somewhat compressed or flattened dorsoventrally over their distal two-thirds and each with single broad posterior seta near base, and longer more slender one anteriorly some distance from base, at beginning of compressed portion. Claws of hind pair (Fig. 22D) short, only about half the length of those of second pair and each with somewhat sinuate lateral margins (when viewed from above or below), with single broad posterior seta near base and somewhat longer seta some distance from apex, as shown in Figure 22E.

According to Crowson (1967) the terga of the ninth and tenth abdominal segments of the subfamily Dynastinae are completely fused as in the case of the Cetoniinae. However, in this species the terga are fairly distinct, which agrees with the drawing by Oberholzer of the *T. coronatus* larva.

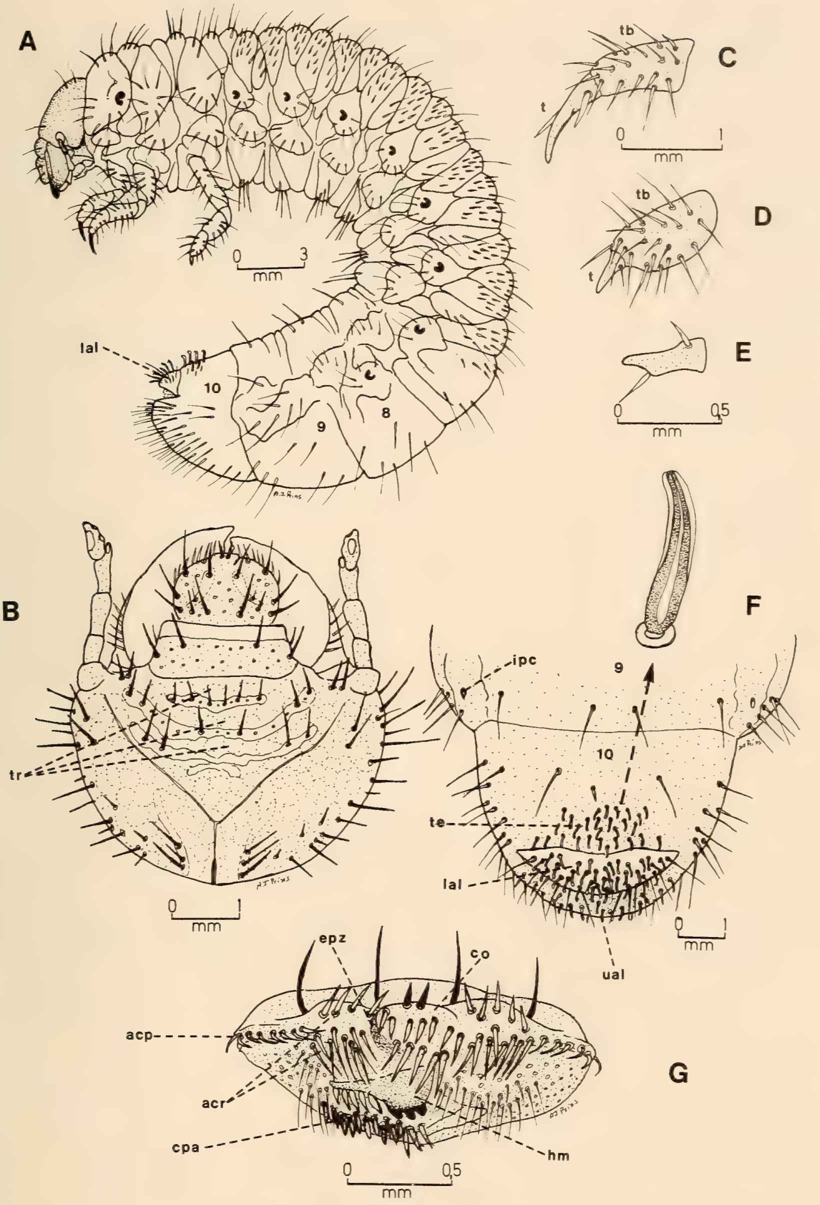

Fig. 22. Scarabaeidae. *Temnorrhynchus retusus* larva. A. Left lateral view. B. Head, dorsal view. C. Tibia and tarsus of mesothoracic leg, posterior view. D. Tibia and tarsus of metathoracic leg, posterior view. E. Claw of metathoracic leg, seen from below. F. Apical abdominal segments, ventral view. G. Anterior margin of labrum, viewed directly from the front.

Head (Fig. 22B)

Slightly less than one-third wider than long, sides and hind margin very convex; reddish to brownish in colour, almost superficially rugoso-reticulate, forming three inconspicuous ridges on frons, separated by areas of lighter sclerotization; first transverse area just behind frontoclypeal suture fairly deeply excavated in some specimens and bearing about six anterior frontal setae. Second light-coloured area bears two exterior frontal setae on each side as well as two paramedian setae. In this species four posterior frontal setae present behind third transverse ridge; otherwise chaetotaxy as illustrated. Frontal and coronal sutures faintly visible.

Four-segmented antennae about half as long as width of head; first, third and apical segments of about equal length, second segment longest. Apical segment with large dorsal oval sensory spot as well as two smaller spots on ventral side; penultimate segment also with oval sensory spot on cone-shaped apical projection.

Labrum and clypeus

Labrum pitted, about one-third wider than long, narrower and about one-third longer than clypeus; its anterior and lateral margins convex. Anterior transverse row of four setae present, one of which is situated on each lateral margin; posterior row of about eight setae as illustrated. Also two spine-like setae present in middle of anterior margin. Clypeus nearly two-thirds wider than long, its anterior margin slightly concave. Postclypeus also pitted with transverse row of four setae, one of which is situated on each lateral margin; also a shorter lateral seta near anterior margin of postclypeus.

Epipharynx (Figs 22G, 23A). Corypha fairly well indicated, with about five strong setae on its ventral margin and about seven bordering the dorsal edge. Epizygum fairly discernible in most specimens seen. Haptomerum strongly sclerotized and with about seven sensilla and three broad teeth or heli flanked on right side by about eight strong dentiform setae of the chaetoparia. Latter beset with strong setae on both sides, the setae diminishing in size towards the plegmatia, forming pitted gymnopariae. Acropariae each with about fifteen long setae of which four to five are situated in a dorsal position. Each acanthoparia with ten to twelve sickle-shaped setae; each seta with indistinct plegma. Pedium well indicated, traversed in middle by narrow anterior epitorma. Both dexio- and laeotorma as narrow strongly sclerotized plates; laeotorma with small almost conical pternotorma, which is rather similar to that of *Rhinocoeta cornuta*. Mesophoba on each side as row of slender setae. Crepis indicated by fold, haptolachus includes an almost triangular sensory plate, a sensory cone and two macrosensilla on each side.

Mandibles (Fig. 23E–F)

Fairly long, about one-third longer than wide. Dorsal carinae rounded and scrobis with one medium-long, broad distal seta and longitudinal row of five small

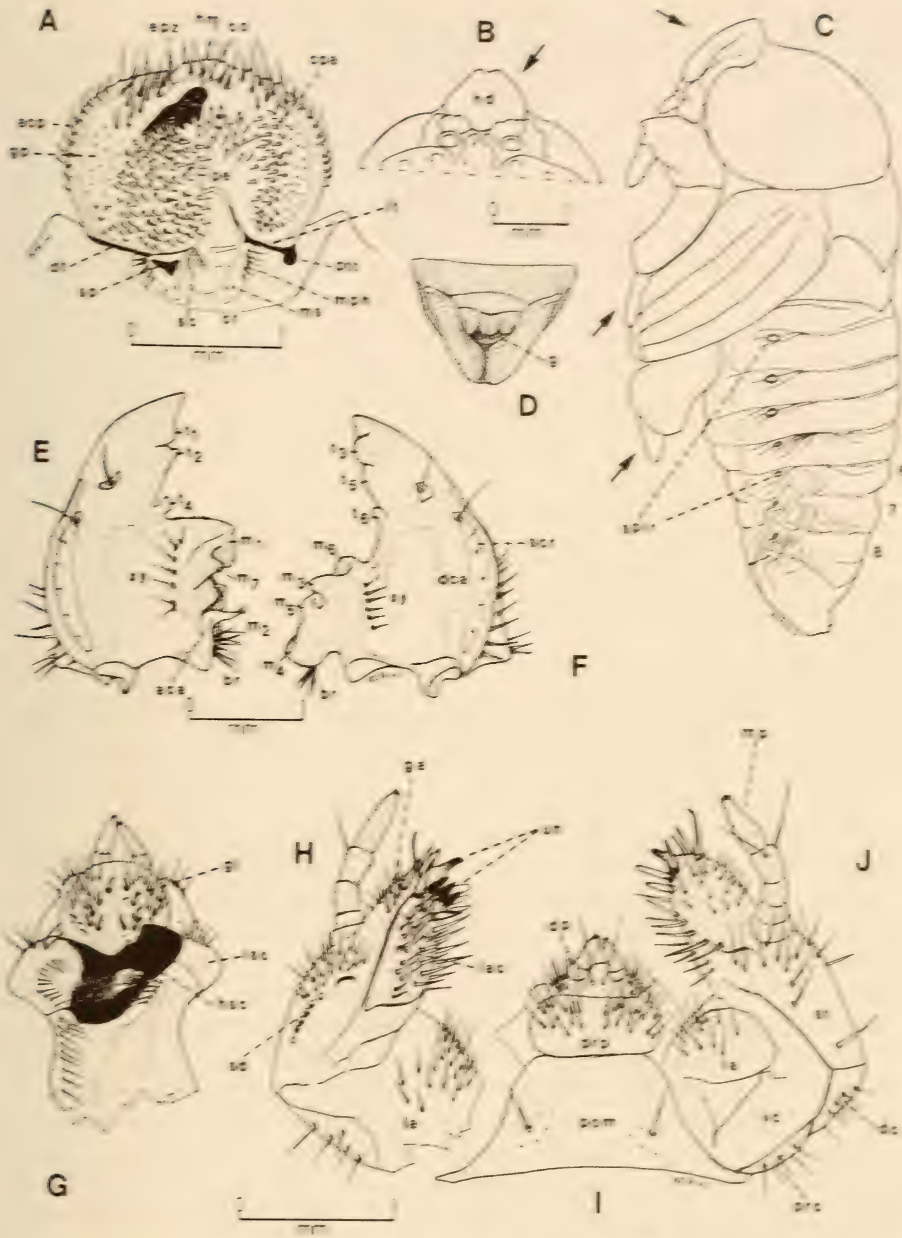

Fig. 23. Scarabaeidae. *Temnorrhynchus retusus*. A. Epipharynx of larva. B–D. Pupa. B. Head, ventral view. C. Left lateral view. D. Apex of abdomen, ventral view showing developing genital capsule. E–J. Larva. E. Left mandible, dorsal view. F. Right mandible, dorsal view. G. Hypopharynx. H. Left maxilla, dorsal view. I. Labium, ventral view. J. Left maxilla, ventral view.

pits, each with short seta. Lateral areas with ten to fourteen setae; also about seven setae at base on ventral carina. Medium-long seta present in depression on neck of scissorial area, about half-way between seta on scrobis and third tooth (t_2 and t_5).

Cutting edge of left mandible with first and second tooth (t_1) united as broad blade, with deep notch between second and third tooth (t_2). Small almost truncate tooth (t_4) present at junction of molar and cutting edge on left mandible, absent in right one but represented by distinct tooth (t_6), present about half-way between rounded third tooth (t_5) and molar area. Second (t_3) and third tooth (t_5) on right mandible rounded, in most specimens rather indistinct, in some almost obsolete.

Molar area on right mandible smaller than that on left, with upper strong tooth (m_3) forming transverse ridge in front of which is fairly distinct ventral tooth (m_6). Second molar tooth (m_5) small, also forming ridge, similar to that of m_3 and strongly developed on ventral side. Posterior tooth (m_4) almost as broad lobe, bearing brustia. Molar area of left mandible with broad lobe-like transverse tooth (m_1) followed by second conical tooth (m_7). Proximal molar area (m_2) in this case broad, rounded posteriorly with almost semi-circular row of about twenty-two strong setae, and forming a short broad anteroventral tooth as well as a broad, conical anterodorsal tooth, behind which is almost triangular acia with four short apical setae. Also row of about seven dorsomolar setae present on inner margin of both molar areas.

Ventrally each mandible with broad, oval stridulatory area with small pit carrying two setae, about half-way between it and molar area (this pit with setae also present in most other scarab larvae).

Maxillae (Fig. 23H, J)

Galea and lacinia united, but clearly indicated by dividing suture on dorsal side, ventrally only by S-shaped sclerotized line. Galea with single long acute uncus at apex, dorsally with three strong setae below uncus and longitudinal row of three to four more slender setae along dividing suture, as well as some smaller slender setae; ventrally also with three strong setae below uncus as well as some more slender setae as indicated in figure; strong palus-like seta present on base of uncus on lateral margin. Lacinia with three conical unci, somewhat smaller than that of galea, bordered by strong broad setae, its mesal margin fairly densely covered with strong setae. Stipes dorsally with about six truncate stridulatory teeth and distad of these obliquely placed rounded and wider stridulatory tubercle; ventrally and dorsally with fine slender setae, some also on lateral margin and single proximal one close to border of disticardo. Palpifer clearly demarcated, without any setae and bearing four-segmented palp of which first segment is shortest; third segment somewhat longer than second and with single ventral and lateral seta; fourth segment longest, about as long as second and third together, and with some sensory cones at apex. Both disti- and proxicardo with some setae, ventrocardo without setae. Labacoria fairly convex ventrally and beset with slender setae on both sides.

Labium (Fig. 23I)

Postmentum slightly wider than long, with single short seta near each posterior corner; proximal sclerite of prementum wider than long, convex, with slender setae; distal sclerite with two long paramedian setae near palpal bases, and some slender setae on each side. Two-segmented palpi with apical segment almost twice as long as first and with sensory pegs at apex.

Hypopharynx (Fig. 23G). Glossa convex, its central disc with short spine-like setae, arranged almost in a circle in some specimens; on each side with slender setae. Hypopharyngeal sclerite strongly sclerotized, asymmetrical, with strong tooth with small depression bearing brush of fine setae on right side; more weakly sclerotized on left. Lateral sclerites less sclerotized, lateral margins acute or pointed in middle, on left with some setae distally, also curved row of fine setae down its middle and along posterior lateral margin; on right side also with some fine setae distally near base of transverse tooth and row near basal border of latter.

Ninth and tenth abdominal sterna (Fig. 22F)

Dividing line between two segments clearly indicated. Ninth sternum with transverse row of four setae near posterior border, two of which are more or less paramedian setae, situated fairly close together. Tenth sternum also with four setae, the median ones far apart. *Raster*: teges with about thirty-five to forty hamate setae; palidium absent; also thirty-five to forty hamate setae on lower anal lip and some on upper anal lip. Internal sclerotized pouch on venter of ninth abdominal sternum similar to that described by Oberholzer (1963) for *T. coronatus*.

Pupa (Fig. 23B–D)

Castaneous brown and rather similar in colour to that of *Rhinocoeta cornuta*. Easily recognized by flat disc on the head as in adult. Hind margin of pronotum almost straight as in *R. cornuta*. Spiracles also similar to those of both the latter and *Pachnoda sinuata*, first four pairs large and oval, first pair covered by wing sheaths; fifth to eighth pair smaller and inconspicuous. Pupa of this species lacks the five pairs of dorsal abdominal tubercles or swellings present in the case of *R. cornuta* and *P. sinuata*. Legs with tarsal sheaths much shorter than in other two species. Developing genital capsule similar to that of *P. sinuata*, but three swellings much more prominent than in latter. Length 23–25 mm.

BIOLOGY

Larvae of *Temnorrhynchus retusus* were found in sandy soils in the Cape Peninsula throughout the year, feeding on the roots of grasses and other garden plants. Pupae formed in clay cells were observed during November and the beetles emerged during December. Newly-emerged beetles are brownish-red to reddish, but assume their normal coloration within a day or two.

Trox rhyparoides Harold

DESCRIPTION

Adult (Fig. 24A)

Peringuey (1901) and Scholtz (1980) give a good description of *Trox rhyparoides*. Blackish, but usually covered with soil which gives it a greyish appearance. Head and thorax closely pitted. Clypeus triangular and pointed in front. Prothorax raised in middle; this raised area wider in front than behind, with three impressions in middle and wider one behind; disc on each side behind this raised area with median carina. Head also with strong transverse ridge intersected in middle by blunt carina which ends at apex of pointed clypeus. Elytra with about eight strong costae, area between them with two rows of foveae with tiny, shiny tubercles in between. Head and prothorax fringed with spoon-shaped hairs.

According to Scholtz (1980) the absence of setal tufts and fringes on the pronotum and elytra and the distinct costal ridges make *T. rhyparoides* a very distinctive species. In specimens examined the lateral margins of elytra have only very small spine-like setae and the fosciculate tubercles, present in other species of *Trox* collected during the surveys, are absent. Length 7,1–8,5 mm.

Widely distributed in the Republic of South Africa and Lesotho, and also present on St. Helena (Scholtz 1980).

Larva (Fig. 24D)

Baker (1968) gives a general description of the larvae of the genus *Trox*. In *T. rhyparoides* mature larvae are almost white with golden-brown head, which is somewhat piceous on the sides above eyes. In young stages, head is pale piceous red. Abdominal segments 1–8 divided into three annulets, those of segments 1–6 and first two annulets of segment 7 bearing short, spine-like setae as well as long hairs. Eighth segment devoid of spines. Prothoracic shield fairly clearly indicated, its front margin straight. Spiracles (Fig. 24M) biforous; under high magnification three sclerotized struts clearly visible, with middle one somewhat stronger than other two. According to Hinton (1967) the trogids have elateroid spiracles which evolved from the primitive type of spiracle in which the orifice of the spiracle is not sufficiently blocked by cuticular struts to prevent the withdrawal through it at ecdysis of the old spiracle and tracheae. Legs well developed and covered with long hairs; claws (Fig. 24E) acute, simple, each bearing two medium-long setae near base.

Small larvae measuring 5,5 mm in length are very similar to full-grown specimens, but differ from the latter in the smaller number of annulets which have spines; in specimens examined only one annulet on each of abdominal segments 1–7 contained spines.

Head (Fig. 24G)

Wider than long; frontoclypeal suture obsolete in middle and forming wide U-shaped depression with four hairless pits. Frons deeply pitted; four of pits on

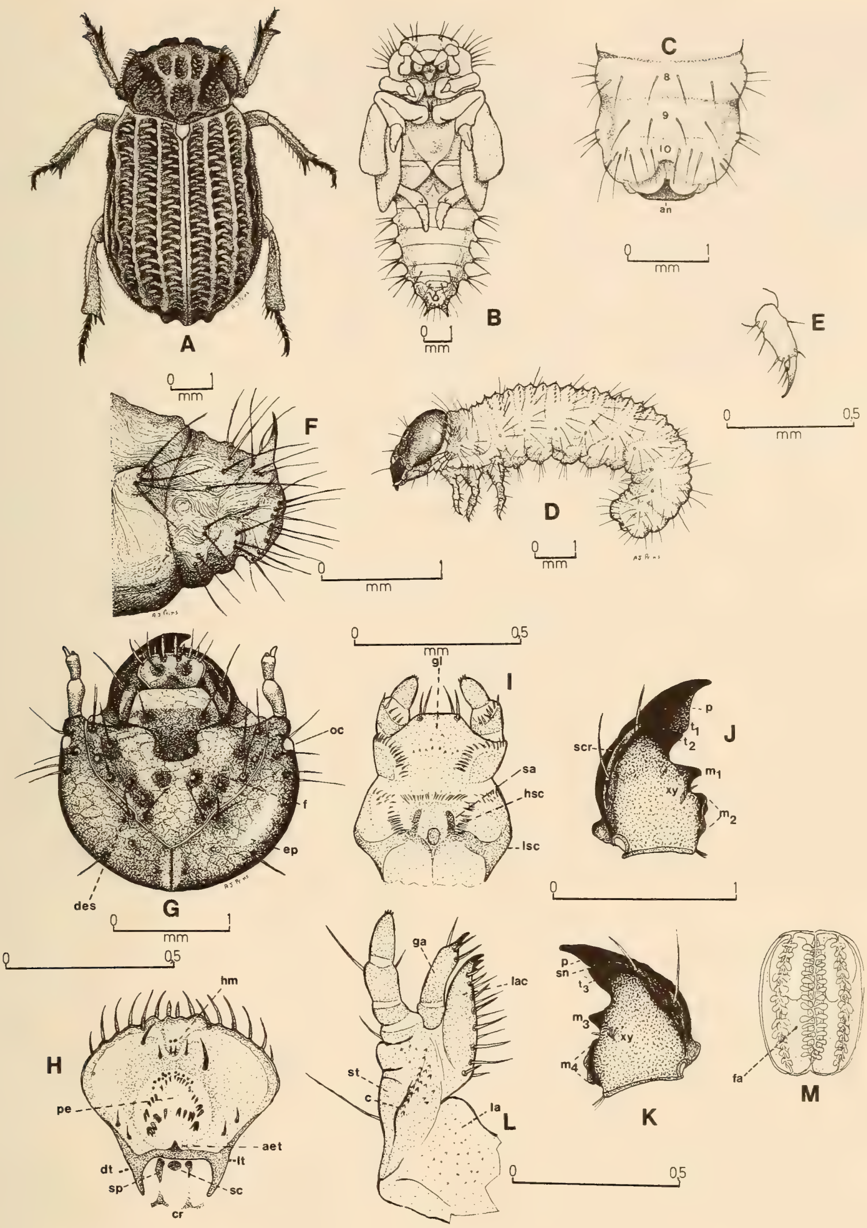

Fig. 24. Scarabaeidae. *Trox rhyparoides*. A. Adult. B. Pupa, ventral view. C–E. Larva. C. Apical abdominal segments, ventral view. D. Larva, left lateral view. E. Right mesothoracic tibia. F. Apex of pupa, left lateral view. G–M. Larva. G. Head, dorsal view. H. Epipharynx. I. Hypopharynx. J. Left mandible, dorsal view. K. Right mandible, dorsal view. L. Left maxilla, dorsal view. M. Biforous abdominal spiracle (highly magnified).

each side with long seta each. Each side of epicranium with four dorsal setae, of which dorso-epicranial one is often double; some pits also hairless. Ocelli present and fairly prominent behind antennal bases. Antennae much shorter than cranium, three-segmented, third segment very small.

In young specimens, measuring 3–3,5 mm, posterior epicranial (exterior dorso-epicranial) setae are absent; otherwise head is similar to that of mature specimens.

Labrum and clypeus

Labrum about as long as clypeus. Its anterior margin not clearly divided by weakly developed clithra; dorsally with six long setae along front margin, as well as two paramedian setae on central disc. Postclypeus with only two setae.

Epipharynx (Fig. 24H). Plegmata and proplegmata absent. Corypha with four strong setae. Acanthoparia with five to six almost sickle-shaped setae. Acroparia represented by three asymmetrically arranged setae on each side of haptomeral area; two long setae (close together) present on right side near anterior border; on left, however, one long seta situated near pedium and one near anterior border; small seta posteriorly on each side of haptomeral area; these setae may be longer in older specimens. Haptomerum almost conical, fairly well sclerotized in old specimens and without teeth in specimens examined, except for two small setae proximally and two sensilla. Pedium raised and convex, central area with stout hairs or groups of spines, particularly on proximal area; distally with short spines and curved row of twelve to fourteen sensilla anterior to these. Tormae (dt and lt) symmetrically developed with short anterior epitorma. Chaetoparia represented by two setae proximally along anterior arms of tormae. Crepis represented by two small sclerotized areas; sclerotization more complete in older specimens; two sclerotized or sensory plates and sensory cone also present.

Mandibles (Fig. 24J–K)

Slightly more than half the length of cranium, both mandibles slightly longer than wide. Dark golden brown in colour with molar, scissorial and lateral edges black. Neck of both mandibles short; scrobis and dorsal carina well developed; scrobis with one long proximal and shorter distal seta. Stridulatory area absent on both mandibles, but each with small brustia.

Left mandible with broad blade-like cutting edge; scissorial notch indicated in most specimens; third tooth (t_2) small and acute in some specimens. Cutting edge of right mandible also fairly broad, with two distinct teeth; second tooth (t_3) broad, scissorial notch well marked in most specimens.

Molar areas of both mandibles divided into two teeth, of which distal tooth (m_1 and m_3) is conical and situated almost half-way between last scissorial tooth (t_2 or t_3) and proximal molar area (m_2 or m_4). Tiny longitudinal groove with fine dorsomolar setae present on both mandibles.

Maxillae (Fig. 24L)

Galea and lacinia free for most of their length. Galea bearing single strong uncus; lacinia with two strong unci and third smaller tooth on ventral side. Galea with five strong setae around uncus of which two are situated ventrally. Lacinia with about thirteen strong setae on mesal margin, arranged more or less in two rows. Stipes with only two long setae, one on ventral side near cardo and one on palpifer; dorsally without setae, but with strong ridge (c) bearing about twenty stridulatory teeth. Cardo with only one short seta on disticardo; labacoria beset with minute spinules. Maxillary palp four-segmented, with two setae on ventral side of penultimate segment and one on ventral side of basal segment. Palpifer not clearly demarcated on dorsal side and bearing few small stridulatory teeth.

Labium

Submentum trapezoidal, with single seta on each side near lateral margin. Mentum convex, with two long setae. Distal sclerite of prementum not divided into lobes but with two setae near anterior margin, one on each side of palpiger. Two setae also present posteriorly near border of proximal sclerite of prementum. Palpiger also with some small spine-like setae on external border.

Hypopharynx (Fig. 24I). Distal region of glossa with only four setae and some minute spines or cones, which are in some specimens almost semi-circularly arranged; also with semi-circular row of fine hairs on each side. Hypopharyngeal sclerite weakly developed and with row of fine hairs in front and on each side; in older specimens hypopharyngeal sclerite more strongly developed, particularly its two anterior arms (subapotormae). Same applies to lateral sclerite (subtormae).

Ninth and tenth abdominal sterna (Fig. 24C)

Dividing line between these segments lacking; ninth sternum with transverse row of about eight setae, tenth with transverse row of about twelve. *Raster* absent. Upper anal lip small, lower anal lip almost semi-circular and divided by slit into two halves. The feebly trilobed anal area suggests relationship to the stag-beetles, Lucanidae (Hayes 1929).

Pupa (Fig. 24B)

Newly formed pupa yellowish white and 8–9 mm long. Anterior and lateral borders of pronotum as well as anterior part of head setose. Meso- and metathorax dorsomedially bearing two closely approximated tubercles, each one with about four setae. Six fleshy protuberances also present laterally on abdomen, each bearing five to seven long setae. Apex of abdomen with long setae and two fairly long hooks pointing upwards (Fig. 24F).

BIOLOGY

Trox rhyparoides beetles were found in large numbers under decaying animals around Cape Town from March to November. They feed on bits and pieces of flesh left on the skeletons as well as on loose hairs scattered on the ground

around the carcasses. Young larvae occurred during May and again during October and pupae were collected around the middle of August and also at the end of October. According to available information, the larval period lasts for about 6 weeks and the pupal stage 10–14 days.

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ABBREVIATIONS

ac	alacardo
aca	acia
acp	acanthoparia
acr	acroparia
aet	anterior epitorma
an	anus
ant	antenna
br	brustia
c; carc	carina; ridge
car	cardo
cl	clithrum
co	corypha
cos	epicranial suture; coronal suture
cpa	chaetoparia
cpp	caudal support projection
cr	crepis
csc	convex sclerite of cardo
cx	coxa

dc	disticardo
dca	dorsal carina
des	dorso-epicranial setae
dp	distal sclerite of prementum
dph	dexiophoba
dt	dexiotorma
e	compound eye
eal	exterior anal lobe
eds	exterior dorso-epicranial setae
ep	epicranium
eps	epipharyngeal sclerome
epz	epizygum, zygum
f	frons
fa	finger-shaped air-tube of biforous spiracle
fe	femur
g	developing genital capsule
ga	galea
gl	glossa
gla	protrusible gland
gp	gymnoparia
gt	gin trap
gu	gula
hd	head
hm	haptomerum
hps; hsc	hypopharyngeal sclerome; hypopharyngeal sclerite
ial	interior anal lobe
ipc	opening of internal sclerotized pouch
k	claw; tarsungulus
jxs	juxtastipes
l	ligula
la	labacoria
lab	labium
labr	labrum
lac	lacinia
lal	lower anal lip
lls	lateral lobe setae
lm	prostheca
lp	labial palp
lph	laeophoba
ls	labial stipes
lsc	lateral sclerite
lt	laeotorma
m	mentum
m_{1-6}	molar areas
ma	mala
md	mandible
mla	superlinguae; maxillulae
mls	median lobe setae
mp	maxillary palp
mph	mesophoba
ms	macrosensillum
mx	maxilla
oc	ocellus
of	occipital foramen
on	oncyli
p	scissorial area
pal	palidium
pam	paramentum
pc	postclypeus
pca	precardo
pe	pedium

pen	penicillus
pet	posterior epitorma
pf	palpifer
pfg	palpiger
pm	prementum
pom	postmentum
prc	proxicardo
prp	proximal sclerite of prementum
pth	protophoba
ptp	pteronotal support projection
ptt	pternotorma
ret	retinaculum
s	spur
sa	subapotorma
sc	sensory cone
sca	subcardo
scr	scrobis
sd	stridulatory teeth
seg; sg	sensory spot
sens	sensory punctures
sep	septum
sh	straining hairs
sj	sensory appendix; supplementary joints of antennae
sm	submentum
sn	scissorial notch
snsc	subnasal sclerite
sp	sensory plate
spir	spiracle
st	maxillary stipes
suc	subcardo
t	tarsungulus
t_{1-6}	mandibular teeth; hypopharyngeal teeth
tb	tibia
te	teges
tgl	tegillum
to	torma
tp	dorsal tergal support projection
tr	transverse ridge
tu	tubercle
ual	upper anal lip
un	uncus
ur	urogomphus
vc	ventrocardo
x	short and long setae on labrum of scarab larva
xy	dorsomolar setae
y	narrow sclerotized plate
yy	spine at base of uncus
z	tuft of hairs
zz	median hairs near labral apex

6. SYSTEMATIC papers must conform to the *International code of zoological nomenclature* (particularly Articles 22 and 51).

Names of new taxa, combinations, synonyms, etc., when used for the first time, must be followed by the appropriate Latin (not English) abbreviation, e.g. gen. nov., sp. nov., comb. nov., syn. nov., etc.

An author's name when cited must follow the name of the taxon without intervening punctuation and not be abbreviated; if the year is added, a comma must separate author's name and year. The author's name (and date, if cited) must be placed in parentheses if a species or subspecies is transferred from its original genus. The name of a subsequent user of a scientific name must be separated from the scientific name by a colon.

Synonymy arrangement should be according to chronology of names, i.e. all published scientific names by which the species previously has been designated are listed in chronological order, with all references to that name following in chronological order, e.g.:

Family **Nuculanidae**

Nuculana (*Lembulus*) *bicuspidata* (Gould, 1845)

Figs 14–15A

Nucula (*Leda*) *bicuspidata* Gould, 1845: 37.
Leda plicifera A. Adams, 1856: 50.
Laeda bicuspidata Hanley, 1859: 118, pl. 228 (fig. 73). Sowerby, 1871: pl. 2 (fig. 8a–b).
Nucula largillierti Philippi, 1861: 87.
Leda bicuspidata: Nicklès, 1950: 163, fig. 301; 1955: 110. Barnard, 1964: 234, figs 8–9.

Note punctuation in the above example:
comma separates author's name and year
semicolon separates more than one reference by the same author
full stop separates references by different authors
figures of plates are enclosed in parentheses to distinguish them from text-figures
dash, not comma, separates consecutive numbers

Synonymy arrangement according to chronology of bibliographic references, whereby the year is placed in front of each entry, and the synonym repeated in full for each entry, is not acceptable.

In describing new species, one specimen must be designated as the holotype; other specimens mentioned in the original description are to be designated paratypes; additional material not regarded as paratypes should be listed separately. The complete data (registration number, depository, description of specimen, locality, collector, date) of the holotype and paratypes must be recorded, e.g.:

Holotype

SAM–A13535 in the South African Museum, Cape Town. Adult female from mid-tide region, King's Beach Port Elizabeth (33°51'S 25°39'E), collected by A. Smith, 15 January 1973.

Note standard form of writing South African Museum registration numbers and date.

7. SPECIAL HOUSE RULES

Capital initial letters

(a) The Figures, Maps and Tables of the paper when referred to in the text
e.g. '. . . the Figure depicting *C. namacolus* . . .'; '. . . in *C. namacolus* (Fig. 10) . . .'

(b) The prefixes of prefixed surnames in all languages, when used in the text, if not preceded by initials or full names
e.g. Du Toit but A. L. du Toit; Von Huene but F. von Huene

(c) Scientific names, but not their vernacular derivatives
e.g. Therocephalia, but therocephalian

Punctuation should be loose, omitting all not strictly necessary

Reference to the author should be expressed in the third person

Roman numerals should be converted to arabic, except when forming part of the title of a book or article, such as
'Revision of the Crustacea. Part VIII. The Amphipoda.'

Specific name must not stand alone, but be preceded by the generic name or its abbreviation to initial capital letter, provided the same generic name is used consecutively.

Name of new genus or species is not to be included in the title: it should be included in the abstract, counter to Recommendation 23 of the Code, to meet the requirements of Biological Abstracts.

A. J. PRINS

MORPHOLOGICAL AND BIOLOGICAL NOTES ON SOME SOUTH AFRICAN ARTHROPODS ASSOCIATED WITH DECAYING ORGANIC MATTER

PART 3

THE FAMILIES DERMESTIDAE, CANTHARIDAE, MELYRIDAE, TENEBRIONIDAE, AND SCARABAEIDAE (COLEOPTERA)

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94 PART 5 DECEMBER 1984 ISSN 0303-2515

ANNALS
OF THE SOUTH AFRICAN MUSEUM

CAPE TOWN

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Title: informative but concise, without abbreviations and not including the names of new genera or species
Author's(s') name(s)
Address(es) of author(s) (institution where work was carried out)
Number of illustrations (figures, enumerated maps and tables, in this order)
(b) *Abstract* of not more than 200 words, intelligible to the reader without reference to the text
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3. MANUSCRIPT, to be submitted in triplicate, should be typewritten and neat, double spaced with 2,5 cm margins all round. First lines of paragraphs should be indented. Tables and a list of legends for illustrations should be typed separately, their positions indicated in the text. All pages should be numbered consecutively.

Major headings of the paper are centred capitals; first subheadings are shouldered small capitals; second subheadings are shouldered italics; third subheadings are indented, shouldered italics. Further subdivisions should be avoided, as also enumeration (never roman numerals) of headings and abbreviations.

Footnotes should be avoided unless they are short and essential.

Only generic and specific names should be underlined to indicate italics; all other marking up should be left to editor and publisher.

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Fischer, P.-H. 1948. Données sur la résistance et de le vitalité des mollusques. *J. Conch., Paris* **88**: 100–140.
Fischer, P.-H., Duval, M. & Raffy, A. 1933. Études sur les échanges respiratoires des littorines. *Archs Zool. exp. gén.* **74**: 627–634.
Kohn, A. J. 1960*a*. Ecological notes on *Conus* (Mollusca: Gastropoda) in the Trincomalee region of Ceylon. *Ann. Mag. nat. Hist.* (13) **2**: 309–320.
Kohn, A. J. 1960*b*. Spawning behaviour, egg masses and larval development in *Conus* from the Indian Ocean. *Bull. Bingham oceanogr. Coll.* **17** (4): 1–51.
Thiele, J. 1910. Mollusca: B. Polyplacophora, Gastropoda marina, Bivalvia. *In:* Schultze, L. *Zoologische und anthropologische Ergebnisse einer Forschungsreise im westlichen und zentralen Süd-Afrika* **4**: 269–270. Jena: Fischer. *Denkschr. med.-naturw. Ges. Jena* **16**: 269–270.

(*continued inside back cover*)

ANNALS OF THE SOUTH AFRICAN MUSEUM

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A NEW SEA ANEMONE FROM SOUTH AFRICA (ANTHOZOA, PTYCHODACTIARIA)

By

K. W. ENGLAND

&

E. A. ROBSON

Cape Town Kaapstad

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By

K. W. England

&

E. A. Robson

Department of Pure & Applied Zoology, University of Reading

(With 11 figures and 2 tables)

[*MS accepted 23 May 1984*]

ABSTRACT

Preactis millardae gen. et sp. nov., found typically off the Atlantic coast of the Cape Peninsula, is described with details of its distribution and behaviour. The species has taxonomic characters that compare with those of *Dactylanthus antarcticus* Carlgren, 1911, and place it in the order Ptychodactiaria, but it also possesses characters that necessitate a redefinition of that order and the creation of a new family, the Preactiidae, to accommodate it. Some additional data are also given on *D. antarcticus*.

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Ann. S. Afr. Mus. **94** (5), 1984: 305–329, 11 figs, 2 tables.

INTRODUCTION

This paper describes a South African sea anemone that is a most interesting addition to a rare and relatively little-known group, the Ptychodactiaria. Until now the Ptychodactiaria have included one species recorded from the Antarctic and one from the Arctic (Carlgren 1949). The description of this new species is introduced with a summary of what is known about its occurrence and biology, together with available photographic records. It is hoped that this will stimulate further discoveries.

Apart from three finds of specimens washed up on beaches, SCUBA divers have discovered the new anemone attached to rocks at depths of 10–20 m. It has been found at Oudekraal off the Atlantic coast of the Cape Peninsula, which would seem to represent a typical habitat (Velimirov *et al.* 1977), and at Roman Rock in False Bay. Stranded specimens have been found at Maclear's Beach (near Cape Point) and near Hermanus. This is undoubtedly a cold-water species that occurs in the Benguela Current (see Day 1970; Brown & Jarman 1978; Andrews & Hutchings 1980; Field *et al.* 1980). Its origin and precise distribution, however, remain unknown. It is worth noting that specimens so far discovered all seem to have been of adult size, and that small anemones or juveniles, which might be expected to occur in a representative cross-section of the population, have not yet been found. Of seven preserved individuals all except the smallest one bear gonads, but nothing is yet known about the life history or about possible modes of dispersal.

OCCURRENCE AND GENERAL OBSERVATIONS

During the period 1972–82 several specimens were collected and information about their distribution and general biology is drawn up here in chronological order. Localities indicated on the map (Fig. 1) are sites corresponding to five sets of records.

ROMAN ROCK, FALSE BAY

Two specimens at about 10 m on red gorgonians were collected by SCUBA diving and brought by R. J. Griffiths to J. H. Day, 3 December 1972. Preserved specimens now mislaid (CP 809, Zoology Department, University of Cape Town), but identifiable from Day's notes and two photographs taken by him: 'Basal disc poorly developed, not attached. Animal mobile, progresses by means of hollow finger-like appendages on column wall. Oral disc smooth no tentacles visible—maybe a few small tentacles inside mouth—requires dissection. Thin translucent body wall—white, column appendages white with yellow-brown tips. Brown radiating lines on basal and oral discs which appear to mark insertion of mesenteries. 2 siphonoglyphs only.'

One of the photographs is shown in Figure 2A.

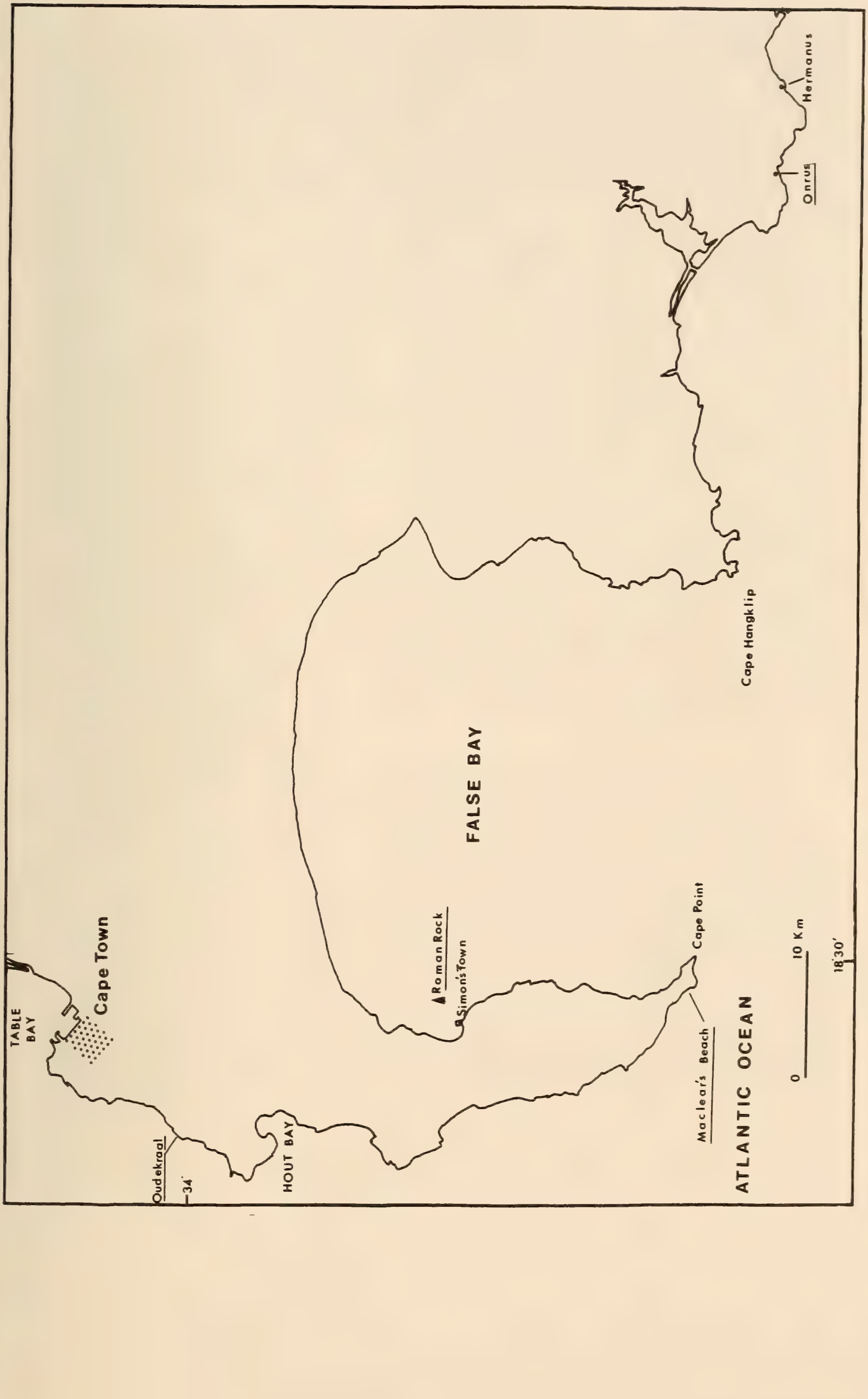


Fig. 1. Map showing collection sites of specimens referred to in the text: Roman Rock, Onrus, Oudekraal and Maclear's Beach are underlined.

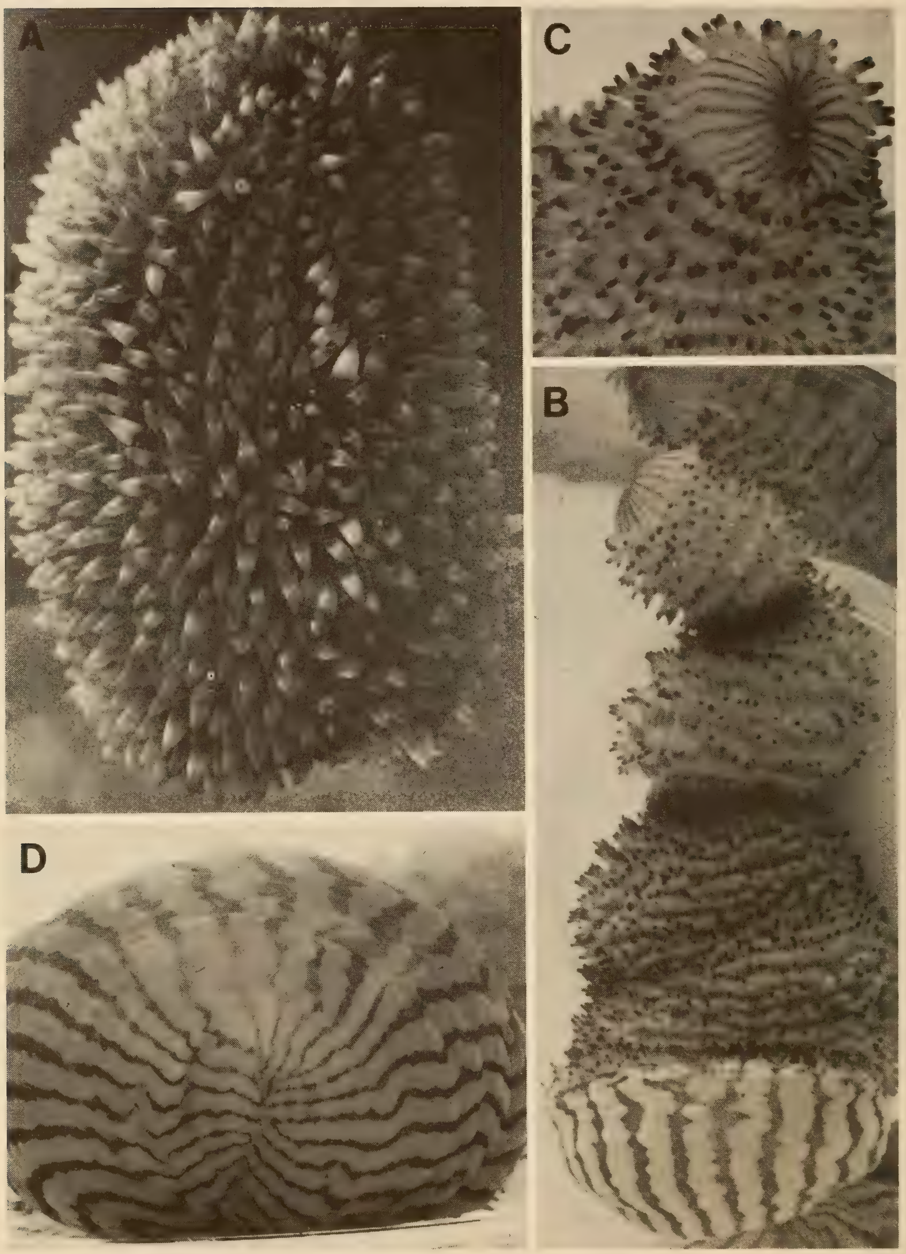


Fig. 2. A. Specimen from Roman Rock, False Bay (CP 809, photo J. H. Day). Note mesentery insertions. Approx. × 1. B–D. Specimen from beach at Onrus (SAM–H1677, photos S. X. Kannemeyer). B. Note peristaltic waves (moving from the base) and vesicles in transverse rows. Approx. × 1. C. Oral disc, × 2. D. Pedal disc, × 1,5.

ONRUS, NEAR HERMANUS

One specimen found loose in a rock pool, collected by M. R. Polchet and brought to N. A. H. Millard at the South African Museum, 4 February 1973. This anemone was observed and preserved by Millard (SAM–H1677), and photographed by S. X. Kannemeyer of the South African Museum. The photographs suggest that the column was up to 13 cm long, the basal disc about 5 cm and the oral disc 1,7 cm in diameter. General coloration orangey-pink: the tips of the vesicles covering the column darker in tone, the column pale. Mouth and oral disc, also the pedal disc, white with twenty-four radial red stripes. The vesicles appeared to be in transverse rows but tentacles were not evident. Millard also noted that the animal made no attempt to attach to the dish by means of the base or vesicles, and performed 'peristaltic' contractions of the whole column. Peristaltic waves moved distally from the base.

The photographs are shown in Figure 2B–D.

Millard's further comments: 'It was probably brought into this coast by currents or wind' (7 May 1973); and 'I have shown the slide to various people and am told that this creature has been seen before several times' (11 April 1975).

OUDEKRAAL, CAPE PENINSULA

A cold-water habitat at about 10–12 °C, very exposed conditions with fast current, depth 10–15 m. About six specimens seen while SCUBA diving by C. L. Griffiths and the two largest were collected on 7 October 1976. All appeared to be 'attached' to a vertical granite rock by the pedal disc: they were vertical in position and 'closed up'. Griffiths observed some variation in size, from perhaps 5 cm upwards, although he thought that apparently smaller specimens might simply have been more contracted. There was some variation in colour between individuals, but the two collected looked almost identical. The habitat is characterized by *Allopora*, gorgonians (*Eunicella*), solitary corals, golf-ball sponges (*Haliclona*) and *Gorgonocephalus*, as described by Velimirov *et al.* (1977).

The two specimens collected (SAM–H2822 and BMNH 1983.4.27.1) were observed and photographed in the Zoology Department, University of Cape Town, by Griffiths and by Robson, who preserved them after making the following notes.

In one specimen the column was at least 20 cm long, the pedal disc 7–9 cm and the oral disc 2 cm in diameter. Vesicles covering the column pinkish mauve with orange tips. Twenty-four radial stripes marking the insertion of mesenteries dark red on the oral disc, orange on the pedal disc. On the column, brownish lines correspond to mesenteries. Background colour pale orange. On the column, vesicles are of all sizes and seem to lack regular alignment. There are two siphonoglyphs, and bilateral symmetry of the pedal disc is also evident.

In the laboratory detached specimens readily change shape. Their mobility of profile gives the impression that behaviour in natural conditions may be fairly

adaptable. Relatively little, however, was discerned as the specimens observed were subjected to bright light and to higher temperatures than usual. This anemone exhibits no specialized rapid contractions. Peristaltic waves were seen to travel quite fast, in this case from the oral disc to the base. The circular muscle of vesicles as well as of the column may be involved. The specimen in Figure 3A reacted to a mechanical stimulus with two or three peristaltic waves after which the column shortened to about 10 cm. When the column was contracted the pedal disc usually became inflated and very thin but it showed no tendency to adhere. The other specimen collected by Griffiths, however, soon afterwards attached itself quite firmly by the base to the bottom of a deep plastic bowl, assuming the shape of a truncated cone. In both specimens the vesicles throughout seemed non-adhesive and they did not move individually unless touched. In general their changes in length or tone were associated with those of other muscles (e.g., as noted, peristalsis of the column) and local responses of their circular and longitudinal muscles were not very evident. In the Oudekraal habitat some ability to reattach to rocks if swept off by the current may be expected, but laboratory observations provided few clues about this.

Griffiths noted in a letter: 'Incidentally, the anemone is quite common—I have mentioned it to several divers and they all know about it' (2 May 1980).

Photographs by Griffiths of one of the specimens are shown in Figure 3A–D. The photograph for Figure 4A was taken by Robson.

MACLEAR'S BEACH, CAPE POINT NATURE RESERVE

Four small specimens found stranded by S. X. Kannemeyer on 4 August 1980 are now in the South African Museum (SAM–H3030). Preserved in alcohol, three of these specimens measure 3, 4 and 5 cm in length respectively.

One stranded specimen found in a tide pool by T. M. Gosliner on 27 November 1981. He noted 'very bright orange coloration'.

Cnidae from SAM–H3030 are shown in Figure 4B.

ATLANTIC COAST OF THE CAPE PENINSULA

Observed by T. M. Gosliner to occur commonly at 10–20 m, e.g. at Hottentot's Huisie, near Oudekraal, during his research dives in the early months of 1981 and 1982.

Gosliner took underwater photographs, and collected and preserved several specimens (including CASIBP 034038 at the California Academy of Sciences, San Francisco, examined by D. F. Dunn). His observations and comments are quoted verbatim from letters:

'We have been finding them commonly (about 5–6 individuals observed during an hour dive). . . . Therefore I suspect that the populations are larger. Generally specimens are loosely attached to the hydrocoral *Allopora nobilis* or other arborescent organisms such as gorgonians. They are usually found on vertical walls in areas of strong current, but do not appear to be orienting into the current' (17 February 1981).

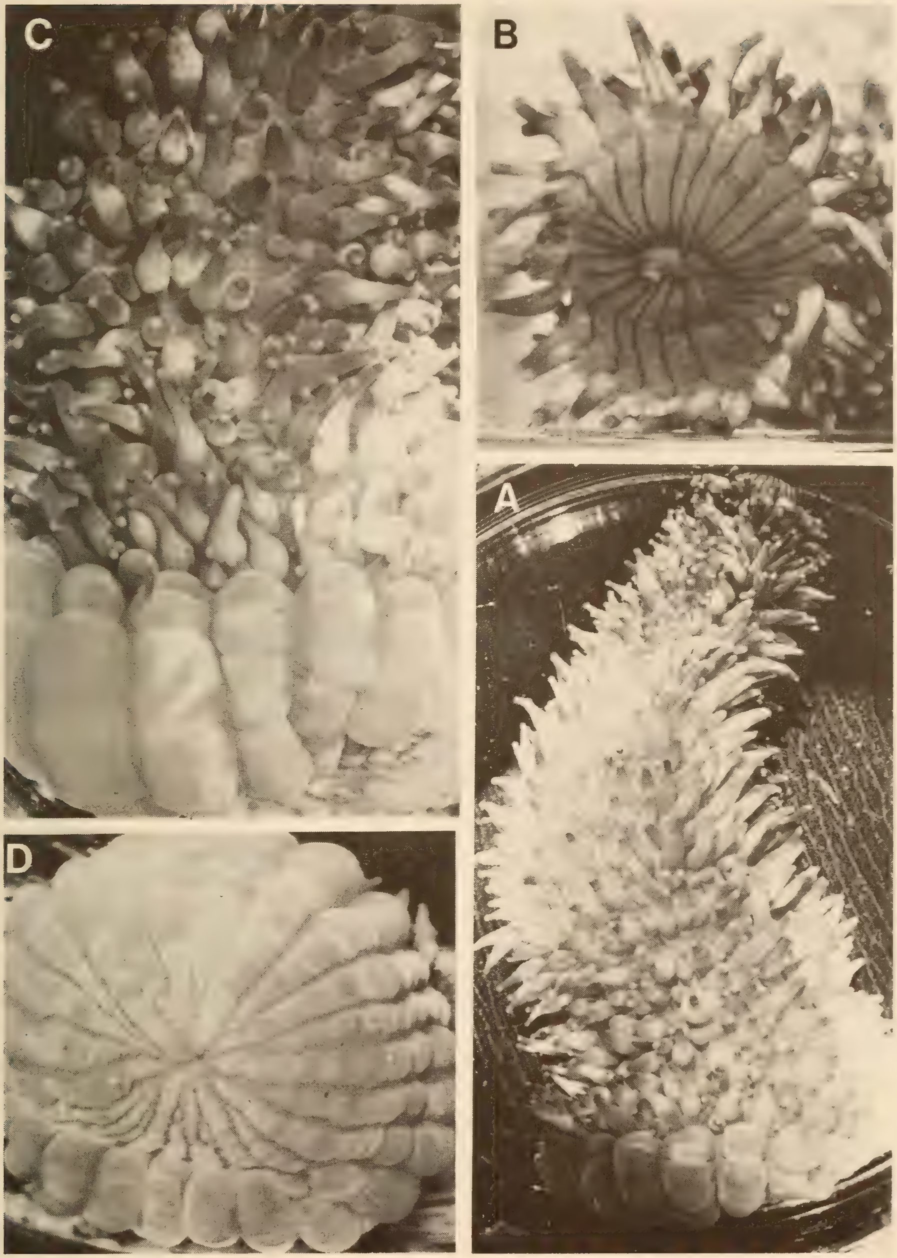


Fig. 3. Specimen from Oudekraal (SAM–H2822, photos C. L. Griffiths). A. Approx. × 0,66. B. × 2. C. Approx. × 1,25. D. × 1.

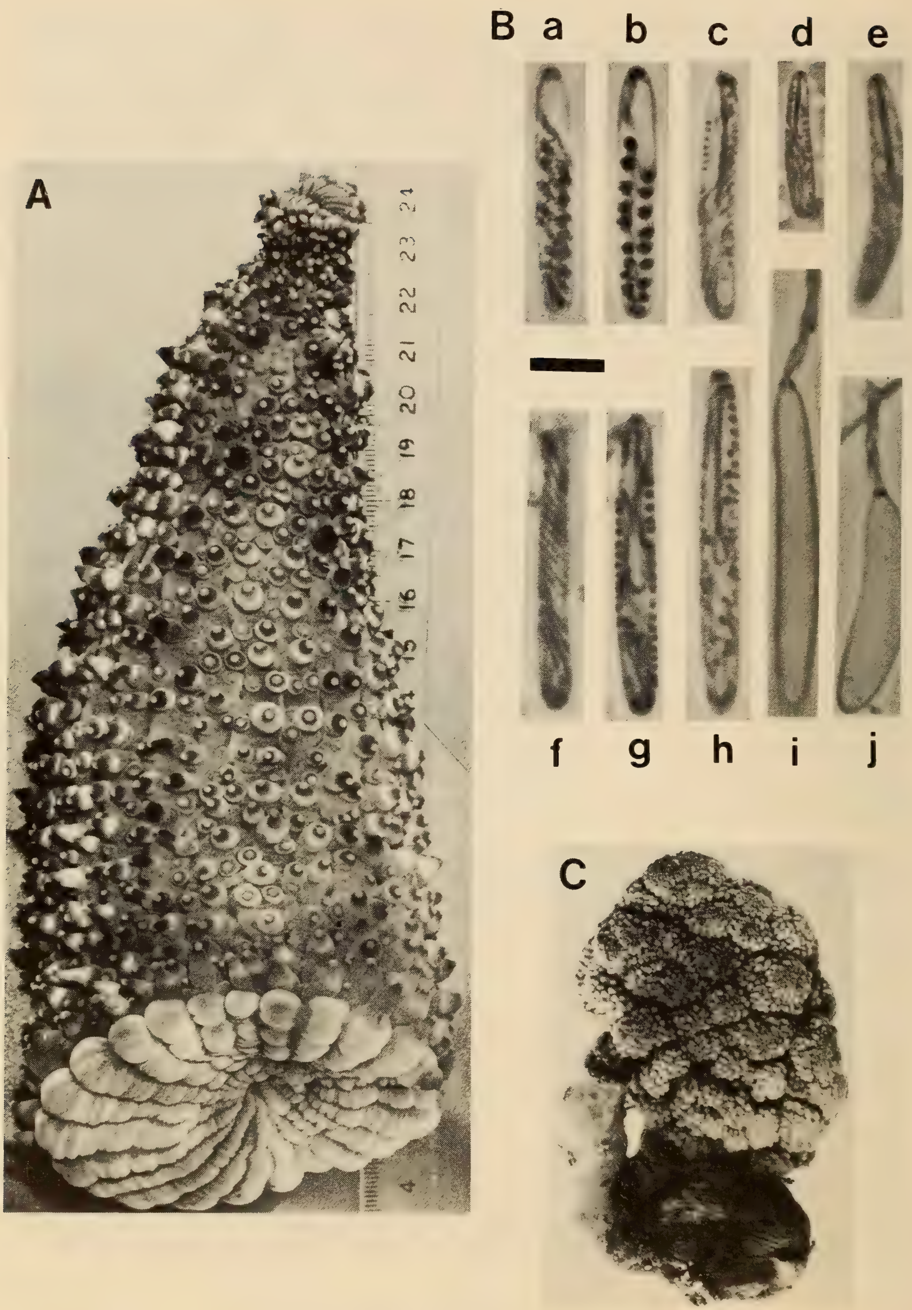


Fig. 4. A. Specimen from Oudekraal (SAM–H2822, photo E. A. Robson). Vesicles have shortened, revealing their irregular size and arrangement in relation to mesentery insertions. Note flatter basal disc, and peristaltic wave starting below the oral disc. Scale in cm. B. Cnidae from tentaculate vesicles (specimens SAM–H3030): a, b—spirocyst at two levels of focus; c, d, e—three basitrichs; f, g—an atrich at two levels of focus; h—atrich; i—discharged atrich; j—discharged basitrich. Bar is 5 μ. C. Preserved specimen of *Capnella thyrsoidea* from Hottentot's Huisie, Oudekraal (SAM–H3169), × 1.

'On a recent dive I observed that one specimen had completely engulfed all but the basal stalk of an alcyonacean, *Capnella [thyrsoidea]*. The colony, which was almost the size of the anemone, completely filled the gastrovascular cavity. On a subsequent dive I observed three more anemones feeding on *Capnella*. One specimen had half-digested a *Capnella* colony. An additional six specimens were observed on that dive and all of them were within 10 cm of the remains of a basal disc of a *Capnella* colony. From these observations I am entirely convinced that [the] anemone is a species-specific predator on this alcyonacean. I think that the presence of the anemones on vertical walls is not through accidental drifting but through active association with their prey, which are most abundant on vertical surfaces. Incidentally, I have never observed any drifting individuals. The animals that I have seen have all been in 10–20 m of water. As *Capnella* occurs down to about 150 [metres] I suspect that the anemones occur much deeper, as well. . . . the strength of attachment I would equate . . . with that of a weakly attached sea cucumber. I have never seen them use the pedal disc in their attachment. I have only observed isolated individuals, never groups. I have seen them within a foot of each other, however. . . . I have not observed any small individuals' (14 April 1981).

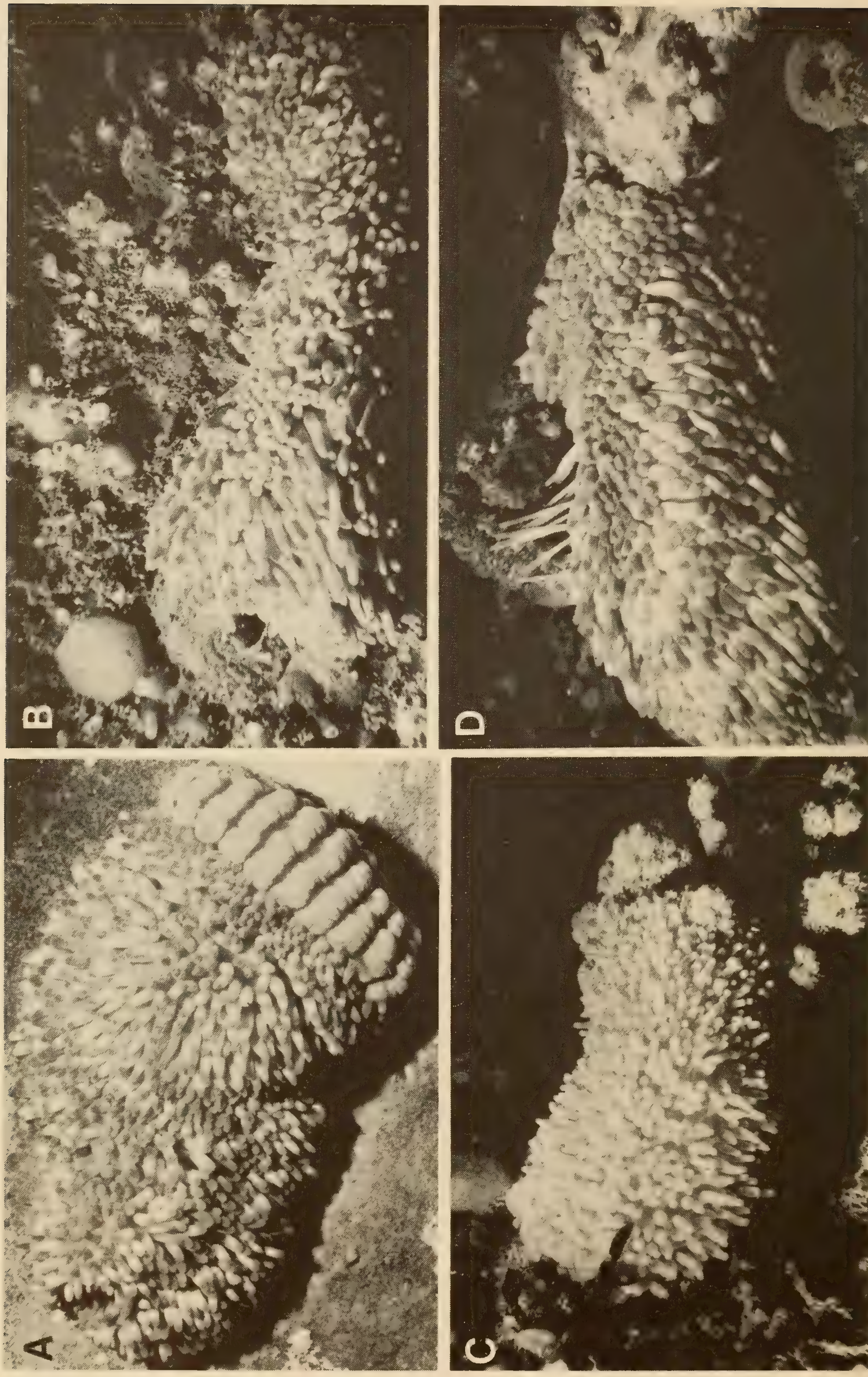
'The only thing I have seen the anemones "do" is eat or hang suspended by their lateral tentacles. I am not sure how long feeding takes but as the whole *Capnella* colony (except for the base) is digested including spicules, I would guess it is a prolonged process. The pedal disc can be used to adhere to the substrate but is always used in conjunction with the lateral tentacles. I have never observed them adhering to the substrate solely by means of the pedal disc in "typical" anemone fashion' (8 June 1982).

Most specimens seen by Gosliner were 10–20 cm in length. He estimates that an expanded colony of *Capnella thyrsoidea* can reach 15 cm in height and perhaps 10 cm in diameter.

Photographs of specimens from Hottentot's Huisie are shown in Figure 5A–D. The site is adjacent to Oudekraal and differs from it mainly in that there is little kelp in the immediate vicinity owing to the steep topography and vertical surfaces. The anemones seen here were all of similar colours. The specimen in Figure 5A has the column and pedal disc pale scarlet, the vesicles iridescent white with orange-red tips, and mesenterial insertions are marked as red lines. In underwater photographs shown in Figure 5B–D, three anemones look brownish pink, one paler than the others, the vesicles with tips of a darker colour, behind which is often a white band. In one case (Fig. 5D) the tips of about ten vesicles, greatly extended, are adhering to (probably) a *Capnella* colony to one side of the anemone. This anemone is already attacking a colony situated in front of the oral disc; exactly how it does this is not yet known.

Note on *Capnella thyrsoidea* (Alcyonacea, family Nephtheidae)

Capnella thyrsoidea (Verrill, 1865) is synonymous with *C. gilchristi* Thomson, 1910 = *C. rugosa* Kükenthal, 1902 (Utinomi 1960; J. Verseveldt, pers.


B
D
A
C

comm.). It appears to have a fairly wide distribution round the South African coast at depths of 11–155 m, extending from the Atlantic coast of the Cape Peninsula and False Bay to northern Natal (see Day *et al.* 1970; and the reference collection of specimens in the Zoology Department, University of Cape Town, identified by A. Tixier-Durivault). Kükenthal (1906) described *C. rugosa* from a specimen obtained south of Mossel Bay at 155 m, and another was reported by Thomson (1910) near East London at about 40 m. The usual substrate is probably rock.

A specimen from Oudekraal collected and preserved by T. M. Gosliner is shown in Figure 4C (SAM–H3169).

TAXONOMIC DESCRIPTION

(By K. W. England)

The discovery of the species of anemone described below necessitates redefinition of the order Ptychodactiaria to which it belongs, and the creation of a new family, the Preactiidae, to separate it from the other members of the order, *Ptychodactis patula* Appellöf (1893: 3–20) and *Dactylanthus (Cystiactis) antarctica* (Clubb 1908: 5–6). These two species are contained in the family Ptychodactiidae.

Order PTYCHODACTIARIA Carlgren, 1949 (redefined)

Diagnosis

Anthozoa (Dodecacorallia) with a definite base, with or without basilar muscles; parietobasilar muscles present or absent. Filaments with or without ciliated tracts. Gonads not enclosed in the mesogloea. Cnidome: spirocysts, atrichs, heterotrichs and basitrichs.

Family **Preactiidae** fam. nov.

Diagnosis

Ptychodactiaria with column covered with tentaculate vesicles which may or may not continue on to the periphery of the oral disc. Actinopharynx well developed. Two siphonoglyphs supported by directive mesenteries. Twelve pairs of mesenteries, mostly perfect, regularly arranged. All or almost all mesenteries fertile. Filaments with ciliated tracts. Basilar muscles present.

Fig. 5 (*facing page*). Specimens of *Preactis millardae* sp. nov. from Hottentot's Huisie, Oudekraal, photographed by T. M. Gosliner. Anemones seen there are 10 to 20 cm long. A. Living specimen photographed in the laboratory. B–D. Underwater photographs of three individuals in natural surroundings. B. Specimen attached to rock surface, stationary; oral disc to the right. C. An expanded colony of *Capnella thyrsoidea* (lower right) being attacked. D. A third individual feeding on *C. thyrsoidea* (to the right). Note that a few extended vesicles are attached by their tips to another *Capnella* colony (upper left).

Preactis gen. nov.

Etymology

As this genus has the characteristics of an actinarian on the one hand but shows the characters of the Ptychodactiaria on the other, the name *Preactis* was coined: *pre* from Latin *prae* = before or in advance, and *actis* from *Actinia* = sea anemone, modern Latin from Greek ακτῖς.

Diagnosis

Preactiidae without ectodermal longitudinal muscles on the column, except where they continue for a short distance from the vesicles. Sphincter absent. Actinopharynx with pocket-like prolongations and deep folds between the siphonoglyphs. Siphonoglyphs well developed and considerably prolonged beyond the length of the actinopharynx. The same number of mesenteries distally and proximally. Mesenteries fused together axially for approximately one-third the length of the column, from the base upwards. Cnidome: spirocysts, atrichs and basitrichs.

Type species

Preactis millardae sp. nov.

Preactis millardae sp. nov.

Figs 2–4B, 5–10A

Material

The following description is based on seven preserved specimens from three localities. All were dissected and histological preparations were made as required.

Holotype

SAM–H1677 in the South African Museum, Cape Town. Adult specimen from rock pool at Onrus, near Hermanus, collected by M. R. Polchet, 4 February 1973.

Paratypes

SAM–H2822 in the South African Museum, Cape Town, and BMNH 1983.4.27.1 in the British Museum (Natural History). Two large adult specimens from Oudekraal, Cape Peninsula, depth 10–15 m, collected together by C. L. Griffiths, 7 October 1976. CASIBP 034038 in California Academy of Sciences, San Francisco. Specimen from Oudekraal, Cape Peninsula, depth 20 m, collected by T. M. Gosliner, January 1981.

Additional material

SAM–H3030 in the South African Museum, Cape Town. Four small specimens (three of these were examined here) from Maclear's Beach, Cape Point Nature Reserve, collected by S. X. Kannemeyer, 4 August 1980.

Sections of SAM–H1677, SAM–H2822, and BMNH 1983.4.27.1, by K. W. England, in the British Museum (Natural History). Sections of CASIBP 034038, by D. F. Dunn, in the California Academy of Sciences, San Francisco.

Etymology

The species is named after Dr N. A. H. Millard, South African Museum, Cape Town.

Description

Column conical, the base wider than the disc. The column completely covered with tentaculate vesicles, arranged irregularly, though in places a vertical or horizontal alignment may occur (see Fig. 2A–B). Near the margin the vesicles occur singly or in pairs over both exo- and endocoels, but further down the column the number in each exo- and endocoel may increase to three or four, arranged in horizontal rows. The rows on the exocoels may or may not line up with those on the adjacent endocoels, and vice versa (Fig. 4A). The vesicles are conical with hemispherical tips, occasionally with a bifurcated tip. The uppermost vesicles are positioned on or near the periphery of the oral disc and may encroach on to the disc (Figs 2C, 3B). An occasional vesicle may occur on the base.

The disc is small and flat with a single central mouth.

The base is circular in outline, the diameter exceeding four times that of the disc and capable of a much greater expansion. The mesenterial insertions can easily be seen through the base tissue. The limbus is distinct.

Anatomy

The musculature of the column is weak and consists only of endodermal circular muscle, which is only one fibre high (fibres less than 1 micron thick), and the mesogloeal surface forms only simple folds (Fig. 8C). Sphincter absent. Ectodermal longitudinal muscle fibres were not seen on the column, and if present they would be less than 0,5 microns in diameter.

The tentaculate vesicles have both circular endodermal muscle and longitudinal ectodermal muscle which continues for only a short distance on to the column.

Two distinct siphonoglyphs are present, supported by directive mesenteries, and are prolonged aborally by as much again as the length of the actinopharynx. Below the mouth the middle portion of the actinopharynx is greatly expanded and in contraction it is thus thrown into several deep folds and pocket-like protuberances in the area between the siphonoglyphs (Fig. 6). This arrangement increases the potential diameter of the actinopharynx for feeding purposes.

The mesenteries are hexamerously arranged in two cycles, $6 + 6 = 12$ pairs. In fully developed individuals all the mesenteries are perfect and fertile and bear well-developed ciliated tracts in the uppermost region of the filaments. In younger specimens some mesenteries of the second cycle may not be completely developed. The lower parts of the perfect mesenteries are fused together axially, the zone of fusion extending from the base upward for approximately one-third

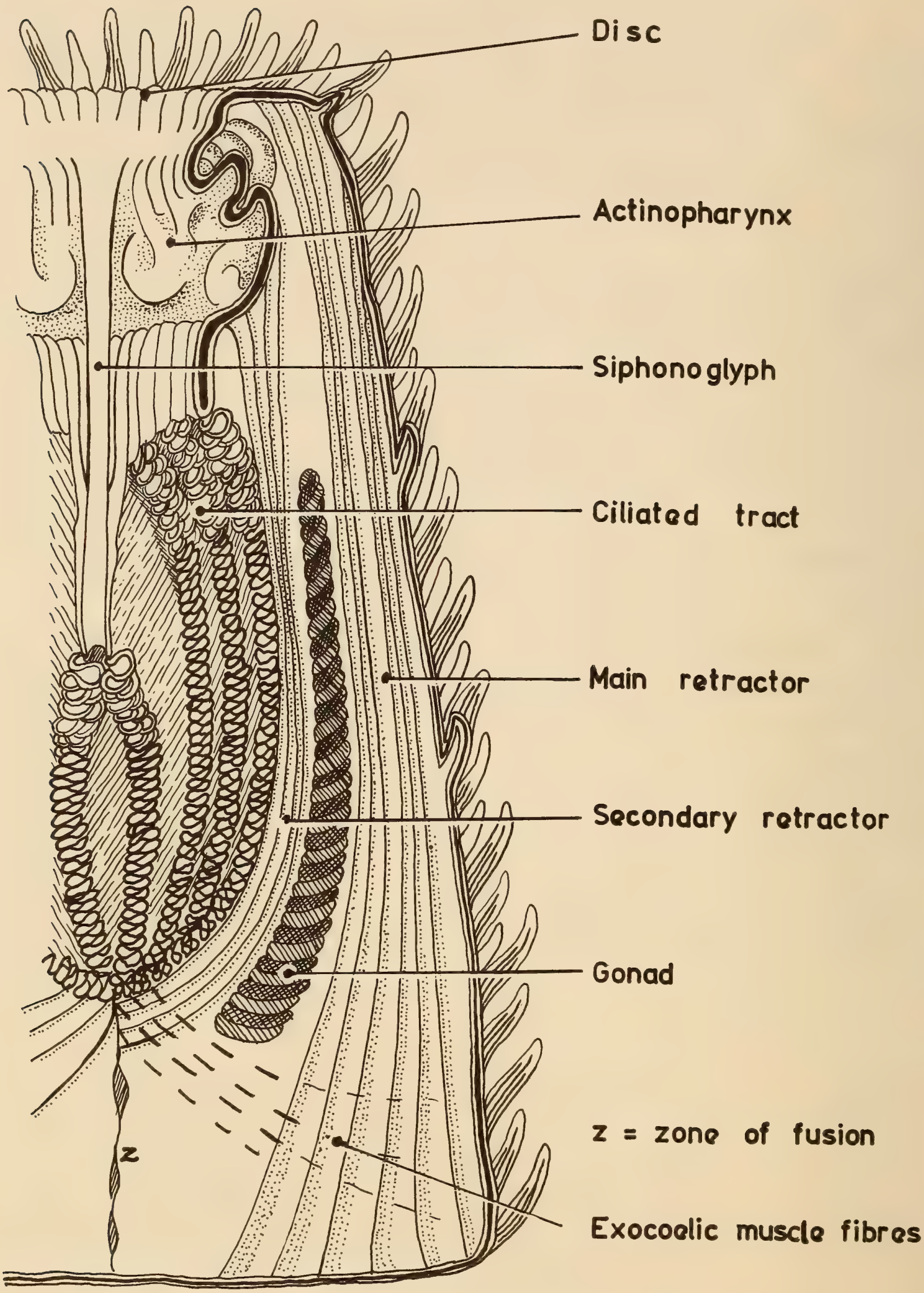


Fig. 6. *Preactis millardae* sp. nov. sectioned longitudinally with endocoelic view of one mesentery (not to scale).

the length of the enteron. The fusion is not complete and openings along the line of fusion remain, connecting the endo- and exocoels (Fig. 6).

The mesenteries possess large oral stomata, but marginal stomata are lacking.

The musculature of the mesentery is weak and unusual (Fig. 7). There are two distinct retractor muscles. The main retractor extends from the base to the discal region, some of the processes terminating under the disc but outer ones ending on the column just below the disc. A secondary or pharyngeal retractor is located behind the filaments, arising from the upper part of the fused portion of the mesenteries and terminating in the region of the expanded middle portion of the actinopharynx (Fig. 6). The reverse side of the mesentery lacks a parietobasilar muscle and, instead, weak muscle bands arise at the top of the fused portion of the mesenteries and fan out towards the column near the limbus, but they become very diffuse and cannot be traced to the column wall (Fig. 6). Very weak basilar muscles are present (Fig. 8A–B).

The gonads occur in a layer on either side of the mesogloea of the mesentery, and they are not embedded in the mesogloea (Fig. 8D). They arise behind the filaments, between the two retractors, and extend from below the actinopharynx down to the region of the fused part of the mesenteries (Fig. 6).

Mesenteries

Inspection shows that mesenteries arise in the normal actinian sequence, and this is reflected in the extent to which they are fused centrally. The first four mesenteries formed—the first two couples—have the longest zones of fusion. Shorter zones of fusion are found in turn in the two pairs of directive mesenteries and in the last two couples, and the shortest are found in mesenteries of the second cycle.

Mesenteries were fully formed in all the specimens examined except in three instances, which seem to be second-cycle mesenteries in the course of development. Their appearance suggests the following sequence of development, although whether these examples are normal or exceptional cannot yet be determined. A pair of mesenteries arises initially at the centre of the column as an inverted pocket on the body wall, closed at the top and open at the bottom (see Fig. 9, which corresponds to a dorsolateral exocoel in specimen BMNH 1983.4.27.1). The pocket grows upward and so moves towards the crown, while splitting progressively along its midline so that two mesenteries are formed. These also grow down the column towards the pedal disc, and filaments form on the free edges below the pocket. Ciliated tracts develop in the appropriate region. It is suggested that the two mesenteries become completely separated when the pocket reaches the top of the column, after which they connect individually with the oral disc and later the pharynx, and proximally with the pedal disc and with the central region of mesenteric fusion.

In one specimen (from SAM–H3030) a pocket giving rise to a pair of second-cycle mesenteries in a lateral exocoel, the mesenteries showing filaments with ciliated tracts and also retractor muscles, was almost fully enclosed in

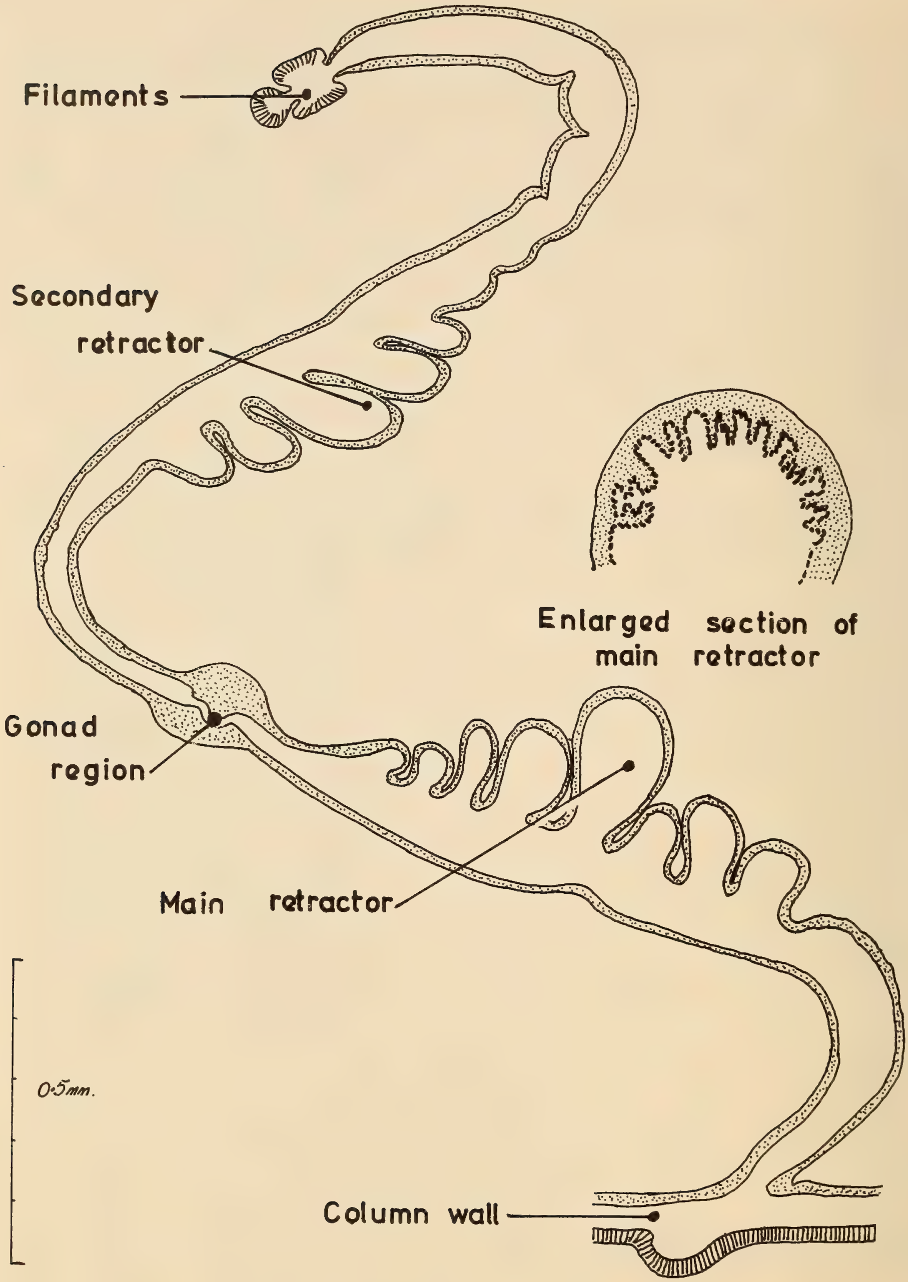


Fig. 7. *Preactis millardae* sp. nov. Transverse section of mesentery illustrating the position and shape of the main and secondary retractors and the position of the gonad.

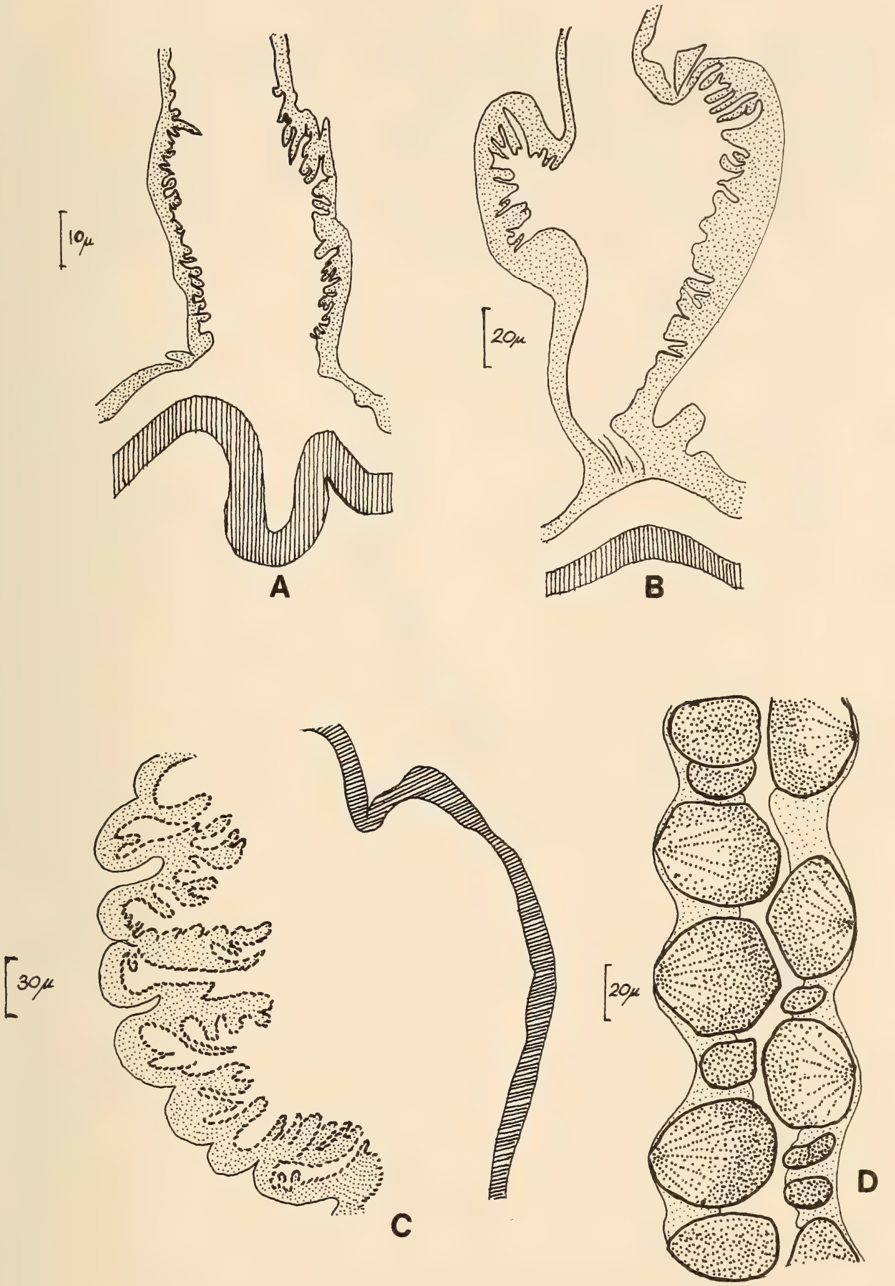


Fig. 8. *Preactis millardae* sp. nov. A. Basilar muscle in a vertical section of the pedal disc (SAM–H1677). B. Basilar muscle in a similar section (SAM–H2822). C. Circular muscle of column in a vertical section below the margin (SAM–H1677). D. Section through the gonad, male (SAM–2822). Endoderm stippled, mesogloea white, ectoderm hatched.

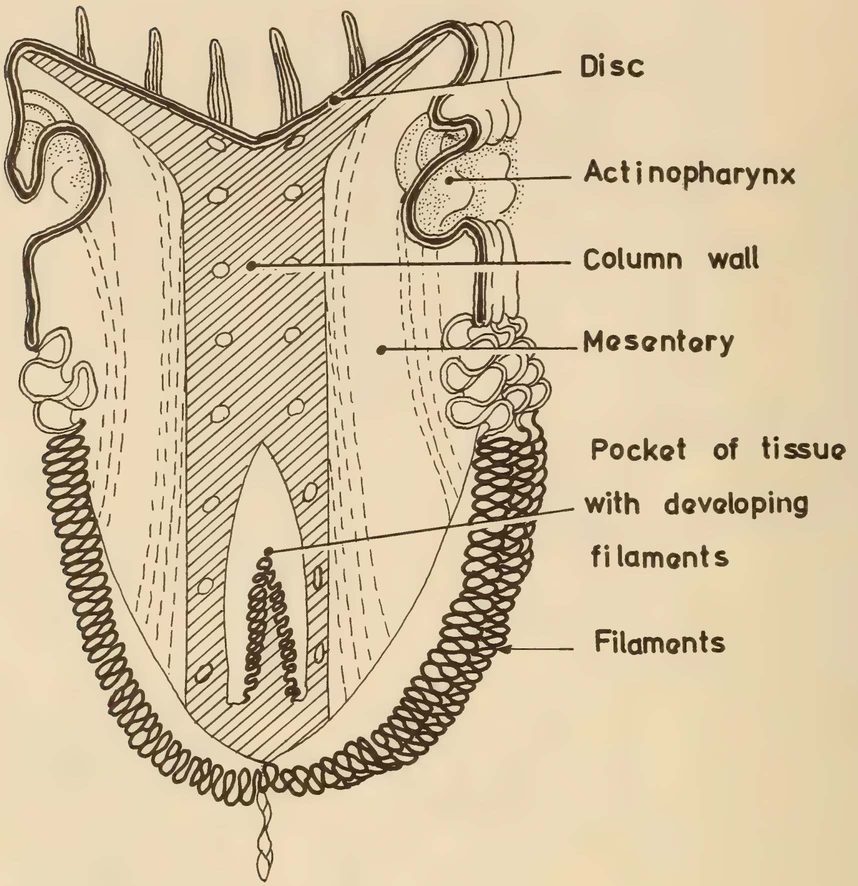


Fig. 9. *Preactis millardae* sp. nov. Diagram of part of a specimen with pharynx and disc cut open radially, showing the position of a pair of developing second-cycle mesenteries: see text.

another pocket. The outer pocket, very large, extended from below the oral disc downward to further even than mid-column. It consisted of two first-cycle mesenteries still joined for two-thirds of their length, the pocket having failed to split along its midline. There were thus no filaments although retractor mucles and gonads were present. These first-cycle mesenteries were also anomalous in being from adjacent pairs (the ventro- and dorsolaterals).

Cnidome

The size ranges and types of cnidae observed are given in Table 1, and the types illustrated in Figures 4B and 10A. Of particular interest is the spirocyst in which the helical folds of the undischarged thread can be seen with the light microscope (Fig. 4B, a–b).

TABLE 1

Cnidae of *Preactis millardae* gen. et sp. nov. (measurements in microns).

Location/Type	SAM–H1677	SAM–H2822	BMNH 1983.4.27.1
Tentacles			
Spirocysts	13,8–16,3 × 2,5	14,6–17,9 × 2,0	14,6–20,0 × 2,6–3,3
Basitrichs	12,5–16,3 × 2,5–3,0	15,2–21,2 (23,8) × 2,0–3,3	13,3–17,9 × 2,0–2,6
Atrichs	20,0–26,3 × 2,5	20,5–27,8 × 2,6–4,0	17,9–31,2 × 2,6–4,0
Disc			
Basitrichs	13,3–15,2 × 2,0–2,6	—	13,3–17,2 × 2,0–2,6
Pharynx			
Atrichs	20,0–22,5 × 2,5–3,0	17,2–23,2 × 2,0–3,3	15,2–25,2 × 2,0–3,3
Basitrichs	—	16,6 × 2,0 (1 only)	15,9–17,9 × 2,6 (3 only)
Filaments			
Atrichs	16,3–22,5 × 2,5	17,9–24,5 (27,8) × 2,0–3,3	18,5–23,8 (26,5) × 2,0–2,6
Basitrichs	—	13,3–15,9 × 2,0 (few)	11,3–13,3 × 2,0–2,6

The size ranges were established by measuring the smallest and largest of each type found, from at least three separate squash preparations taken from different sites of each area examined, i.e., the tentacles, disc, actinopharynx, and filaments. Examination was carried out using normal light microscopy (bright field and phase contrast).

Identification

From the foregoing description it is evident that this species resembles in many respects *Dactylanthus antarcticus* Carlgren, 1911 (Dunn 1983). The possibility of *Dactylanthus* being a young or less well-developed form of the present species was considered, and so the specimen of *D. antarcticus* described and identified by Stephenson (1918) from the Terra Nova Expedition was examined (BMNH 1918.5.12.4).

Although histological sections were not made, a few new details can be added to the descriptions given by Clubb (1908) and Carlgren (1911). *Dactylanthus* has a double retractor muscle similar to that of the new species, the second or pharyngeal retractor being in the same position. The gonads similarly occur between the two retractors but they are lower down the column than in the new species, although not completely below the filaments as stated and illustrated by Carlgren (1911, pl. 1 (fig. 3)). The specimen shows no evidence of parietobasilar muscles.

The nematocysts of *Dactylanthyus antarcticus* were examined and good agreement with the size ranges given by Carlgren (1940) was achieved. Dunn (1983) redescribed *D. antarcticus* and her measurements for the nematocysts are slightly larger than here but of the same order of magnitude. In addition, heterotrichs were found and a few nematocysts were seen that resembled holotrichs. It is thought that the latter were probably developing atrichs, but further work is required to substantiate this possibility. The types and size ranges of cnidae found were as follows:

Vesicles of column:	Spirocysts	16,3–21,3 × approx. 2,0 μ
	Atrichs	18,8–31,7 × 3,0–4,0 μ
	Heterotrichs	7,5–15,6 × approx. 2,0 μ
Actinopharynx:	Atrichs	11,3–23,2 × 2,0–3,3 μ
Filaments:	Atrichs	11,3–18,8 × 2,0–2,5 μ

These are illustrated in Figure 10B. The differences between the nematocysts of *Dactylanthus* and of the new species can be seen by comparing the cnidae of Figure 10A–B. Although the types of nematocysts are the same in both, the spirocysts differ: in *Dactylanthus* they are more like those found in the Actiniaria in that the folds of the thread are not visible and the thread occupies more of the capsule.

From the study of cnidae it is clear that *Dactylanthus* is not a young form of the new species.

The taxonomic characters of the new species and those of *Dactylanthus* are given in Table 2, listed in the order in which they would be examined, together with those of *Ptychodactis patula* Appellöf, 1893. It can now be seen that the new species differs from both the others in three features that are of major taxonomic importance, i.e.

(i) ectodermal longitudinal muscle of the column is absent,
(ii) ciliated tracts are present on all filaments,
(iii) basilar muscles are present.

Table 2

Comparison of the major characters of *Ptychodactis, Dactylanthus,* and *Preactis* gen. nov.

	Ptychodactis	*Dactylanthus*	*Preactis* gen. nov.
1.	Column smooth.	Column with single vertical rows of tentaculate vesicles over each endo- and exocoel.	Column with multiple irregular rows of tentaculate vesicles over each endo- and exocoel.
2.	Tentacles present on oral disc.	No tentacles on oral disc but peripheral tentaculate vesicles.	No tentacles on oral disc but peripheral tentaculate vesicles.
3.	Ectodermal longitudinal muscle present on column.	Ectodermal longitudinal muscle present on column.	No ectodermal longitudinal muscle on column.
4.	No sphincter.	Weak sphincter present.	No sphincter.
5.	Up to four cycles of mesenteries present.	Six pairs of mesenteries perfect.	Twelve pairs of mesenteries perfect.
6.	Mesenteries not fused together near the base.	Mesenteries fused together axially near the base.	Mesenteries fused together axially near the base.
7.	No ciliated tracts.	No ciliated tracts, but filaments of second cycle terminate in bilobed funnel.	Ciliated tracts present, bilobed funnels absent.
8.	Gonads not enclosed in the mesogloea.	Gonads not enclosed in the mesogloea.	Gonads not enclosed in the mesogloea.
9.	Basilar muscles absent.	Basilar muscles absent.	Basilar muscles present.
10.	Parietobasilar muscles present.	Parietobasilar muscles absent (p.323).	Parietobasilar muscles absent.

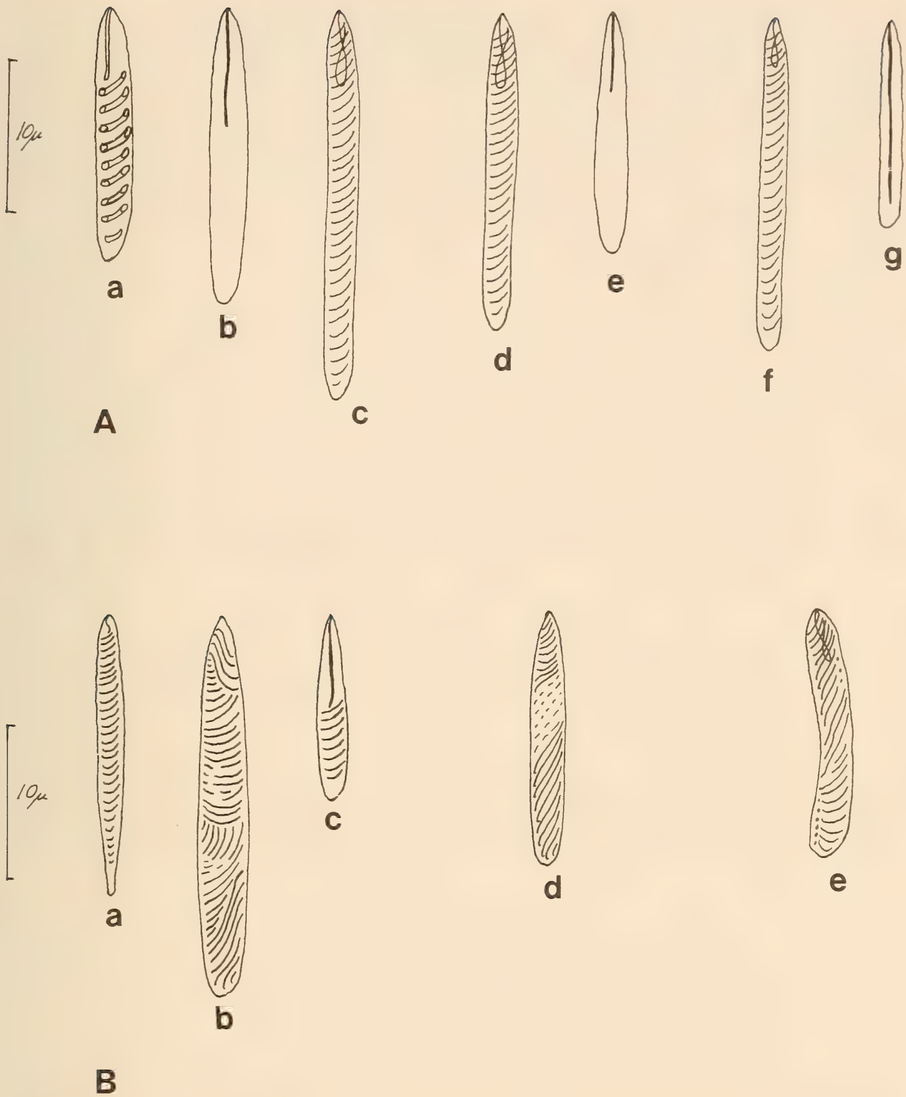


Fig. 10. A. *Preactis millardae* sp. nov. Cnidae (see Table 1). Vesicles: a—spirocyst, b—basitrich, c—atrich. Pharynx: d—atrich, e—basitrich. Filaments: f—atrich, g—basitrich.
B. *Dactylanthus antarcticus* (BMNH 1918.5.12.4). Cnidae. Vesicles: a—spirocyst, b—atrich, c—heterotrich. Pharynx: d—atrich. Filaments: e—atrich.

These features prevent the new species from being referred either to *Dactylanthus* or to *Ptychodactis*. Furthermore, they would even rule out the inclusion of this species in the Ptychodactiaria as defined by Carlgren (1949) and would suggest that it belongs to the Actiniaria. However, as the gonads are not enclosed in the mesogloea of the mesenteries, the Actiniaria are precluded.

The combination of these few but significant features with gonads not contained in the mesogloea suggests a species that in some respects may be intermediate between the Ptychodactiaria and the Actiniaria, and the name *Preactis* gen. nov. is proposed to reflect this.

It is also proposed to redefine the order Ptychodactiaria to accommodate the new genus (p. 315). The primary character of the Ptychodactiaria becomes the presence of gonads not enclosed in the mesogloea, and other characters in Carlgren's (1949) diagnosis are modified, i.e. ciliated tracts present or absent, and basilar muscles present or absent.

If Carlgren's taxonomic criteria are applied it is not possible to include *Preactis* in the family Ptychodactiidae. Carlgren (1942) considered the presence or absence of basilar muscles an important character of fairly high classificatory value, and he did not place species with and without them in one family. The presence or absence of ciliated tracts on the filaments is of similar significance. In order to accommodate *Preactis*, which possesses basilar muscles and ciliated tracts (whereas *Dactylanthus* and *Ptychodactis* do not), a new family in the Ptychodactiaria is proposed. The diagnosis of this family, the Preactiidae fam. nov., is given on p. 315.

Order Ptychodactiaria

Ptychodactiidae	Preactiidae
genus *Ptychodactis*	genus *Preactis*
genus *Dactylanthus*	

It is clear that further research is needed to resolve the taxonomic anomalies offered by the Ptychodactiidae, for it will be appreciated that *Dactylanthus* and *Preactis* are much more alike than *Dactylanthus* and *Ptychodactis*.

COMMENTS

The affinities of the Ptychodactiaria and their geographical distribution deserve further thought.

The higher taxa of Anthozoa as Carlgren saw them in 1949 are these:

ANTHOZOA

Subclass Zoantharia
- Orders Ptychodactiaria
  - Corallimorpharia
  - Actiniaria
  - Madreporaria
  - Zoantharia
  - Antipatharia
  - Ceriantharia

Subclass Alcyonaria

In 1944 he expressed his views on 'the lines of development of the Anthozoa' as a diagram (see, however, the more recent views of Schmidt & Zissler 1979). Carlgren's graphic presentation is conveyed in Figure 11. He considered the Ptychodactiaria as 'a primitive group which has separated early from the Actiniaria and gone their own way' (Carlgren 1942).

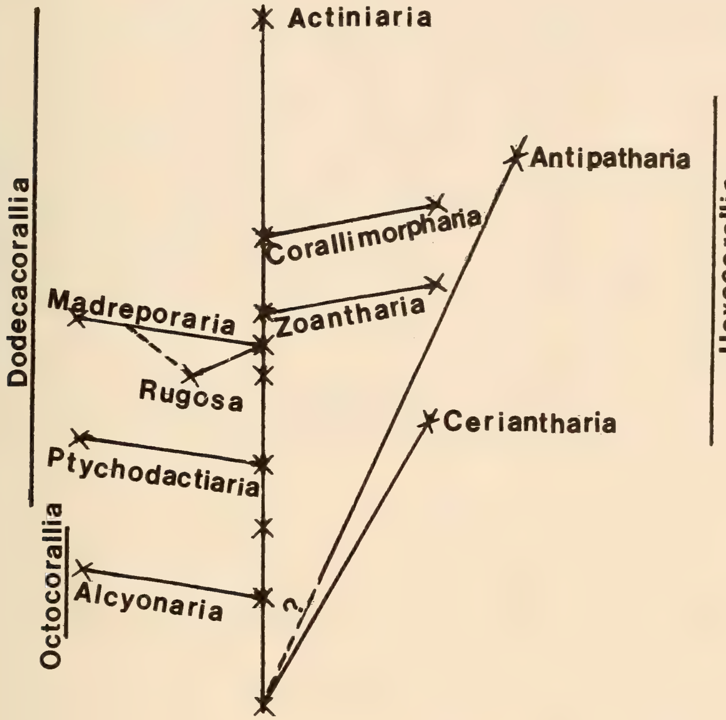


Fig. 11. Diagram after Carlgren (1944), depicting his view of lines of development in the Anthozoa.

Whether the Ptychodactiaria are primitive or, as judged earlier by Stephenson (1921), 'a collection of curiosities which have developed along a little line of their own', new observations are now needed on *Ptychodactis patula,* if possible on living material. It has an arctic-boreal distribution (Carlgren 1949) and Appellöf's (1893) specimens were found on gorgonians. Details of its biology are quite unknown, however, and the same is true of *Dactylanthus*. The functions of special anatomical features are difficult to infer from preserved specimens and the muscular and ciliary systems, for example, need re-examination.

The features of *Dactylanthus* that separate it from *Ptychodactis* and relate it to *Preactis* may be considered to include its Antarctic distribution. The distribution of *D. antarcticus* is summarized by Dunn (1983) as south of the 64th parallel,

on both sides of Drake Passage between 56° and 65°W, and in the Ross Sea and north of it (162°W to 170°E). A circumpolar distribution of this kind would have followed the isolation of the Antarctic continent (i.e. post-Eocene: Frakes 1979). It is possible to speculate that if *Preactis* were derived from the same ancestral Antarctic stock as *Dactylanthus* the formerly narrower polar seas might have allowed ancestral pelagic larval stages to be carried northward by currents towards southern Africa and elsewhere. Although the life history of Ptychodactiaria is still unknown, *Dactylanthus, Preactis* and *Ptychodactis* all have numerous and small oocytes and the existence of pelagic larvae seems probable.

In view of the distribution of *Preactis millardae* (Fig. 1) it is worth mentioning that Carlgren (1938) thought two species of littoral sea anemones from the Atlantic coast of the Cape Peninsula to be 'certainly of subantarctic origin'. *Phellia aucklandica*, collected from Oudekraal at low water by T. A. Stephenson, he found identical to specimens from the Auckland Islands, the Inaccessible Archipelago and Gough Island. *Helianthella annularis*, from Oudekraal and Kommetjie, is an intertidal species with a brood pouch first described by Carlgren (1938). He considered it to show a close resemblance to *H. kerguelensis* found at Kerguelen and Macquarie Island.

The discovery of *Preactis millardae* raises very interesting questions on the taxonomy, zoogeographical history and phylogeny of the Ptychodactiaria and it is hoped that a greater awareness of these animals may lead to further work on their biology.

ACKNOWLEDGEMENTS

Several colleagues have contributed materially to this paper: without Professor J. H. Day, Dr T. M. Gosliner, Dr C. L. Griffiths and Dr N. A. H. Millard there would be few recorded observations and fewer, if any, specimens. It is a pleasure to thank them for their generous help. Dr R. J. Griffiths, M. R. Polchet and Mr S. X. Kannemeyer are thanked for collecting some of the specimens. A visit by E. A. Robson to the Zoology Department, University of Cape Town, in 1976, for which thanks are due to Professor A. C. Brown, made it possible subsequently to collate existing records and to include them here. Dr D. F. Dunn is thanked for valuable comments and for sending us her review of *Dactylanthus* before publication. Dr J. Verseveldt of the Rijksmuseum van Natuurlijke Historie, Leiden, kindly identified the specimen of *Capnella thyrsoidea* shown in Figure 4C.

NOTE IN PRESS

The authors have seen photographs taken by S. Gerber of a probable further specimen of this anemone. The specimen was observed near Gordon's Bay, nearly due east from Simonstown at the opposite side of False Bay (April 1984, 25 m depth, 5,7 km offshore). We wish to thank Mr S. Gerber from Stellenbosch and Miss E. Louw of the South African Museum for providing this information.

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6. SYSTEMATIC papers must conform to the *International code of zoological nomenclature* (particularly Articles 22 and 51).

Names of new taxa, combinations, synonyms, etc., when used for the first time, must be followed by the appropriate Latin (not English) abbreviation, e.g. gen. nov., sp. nov., comb. nov., syn. nov., etc.

An author's name when cited must follow the name of the taxon without intervening punctuation and not be abbreviated; if the year is added, a comma must separate author's name and year. The author's name (and date, if cited) must be placed in parentheses if a species or subspecies is transferred from its original genus. The name of a subsequent user of a scientific name must be separated from the scientific name by a colon.

Synonymy arrangement should be according to chronology of names, i.e. all published scientific names by which the species previously has been designated are listed in chronological order, with all references to that name following in chronological order, e.g.:

Family **Nuculanidae**

Nuculana (*Lembulus*) *bicuspidata* (Gould, 1845)

Figs 14–15A

Nucula (*Leda*) *bicuspidata* Gould, 1845: 37.
Leda plicifera A. Adams, 1856: 50.
Laeda bicuspidata Hanley, 1859: 118, pl. 228 (fig. 73). Sowerby, 1871: pl. 2 (fig. 8a–b).
Nucula largillierti Philippi, 1861: 87.
Leda bicuspidata: Nicklès, 1950: 163, fig. 301; 1955: 110. Barnard, 1964: 234, figs 8–9.

Note punctuation in the above example:
comma separates author's name and year
semicolon separates more than one reference by the same author
full stop separates references by different authors
figures of plates are enclosed in parentheses to distinguish them from text-figures
dash, not comma, separates consecutive numbers

Synonymy arrangement according to chronology of bibliographic references, whereby the year is placed in front of each entry, and the synonym repeated in full for each entry, is not acceptable.

In describing new species, one specimen must be designated as the holotype; other specimens mentioned in the original description are to be designated paratypes; additional material not regarded as paratypes should be listed separately. The complete data (registration number, depository, description of specimen, locality, collector, date) of the holotype and paratypes must be recorded, e.g.:

Holotype
SAM–A13535 in the South African Museum, Cape Town. Adult female from mid-tide region, King's Beach Port Elizabeth (33°51′S 25°39′E), collected by A. Smith, 15 January 1973.

Note standard form of writing South African Museum registration numbers and date.

7. SPECIAL HOUSE RULES

Capital initial letters

(a) The Figures, Maps and Tables of the paper when referred to in the text
e.g. '. . . the Figure depicting *C. namacolus* . . .'; '. . . in *C. namacolus* (Fig. 10) . . .'

(b) The prefixes of prefixed surnames in all languages, when used in the text, if not preceded by initials or full names
e.g. Du Toit but A. L. du Toit; Von Huene but F. von Huene

(c) Scientific names, but not their vernacular derivatives
e.g. Therocephalia, but therocephalian

Punctuation should be loose, omitting all not strictly necessary

Reference to the author should be expressed in the third person

Roman numerals should be converted to arabic, except when forming part of the title of a book or article, such as
'Revision of the Crustacea. Part VIII. The Amphipoda.'

Specific name must not stand alone, but be preceded by the generic name or its abbreviation to initial capital letter, provided the same generic name is used consecutively.

Name of new genus or species is not to be included in the title: it should be included in the abstract, counter to Recommendation 23 of the Code, to meet the requirements of Biological Abstracts.

K. W. ENGLAND & E. A. ROBSON

A NEW SEA ANEMONE FROM SOUTH AFRICA (ANTHOZOA, PTYCHODACTIARIA)

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